March 1976
Volume 20
Number 2

Mariners Weather Log

National Oceanic and Atmospheric Administration • Environmental Data Service

U.S. DEPARTMENT OF COMMERCE
Elliot L. Richardson, Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Robert M. White, Administrator

ENVIRONMENTAL DATA SERVICE
Thomas S. Austin, Director

Mariners Weather Log

Editor: Elwyn E. Wilson
Editorial Assistant: Annette Farrall

March 1976
Volume 20 Number 2
Washington, D. C.

Cover: The Russian vessel GORIZONT rests with her bow out of the water in the English Channel after a collision with a Moroccan freighter. Heavy traffic combined with poor weather conditions makes the Channel a particularly bad area for marine casualties. An article, "Weather and Maritime Casualty Statistics," appears on page 74. Wide World Photo.

Routing
Master ____________

Observing Officers
____
____
____

Radio Officer ____________

PARTICIPATE IN AMVER

PLEASE PASS THIS ISSUE ALONG

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical approved by the Director of the Office of Management and Budget through June 30, 1980.

Copies are available to persons or agencies with a marine interest from the Environmental Data Service, D762, Page Building 1, Room 400, Washington, D.C. 20235. Telephone 202-634-7395. Telephone 202-634-7394.

Mariners Weather Log

NORTH ATLANTIC TROPICAL CYCLONES, 1975

Paul J. Hebert
National Hurricane Center, NOAA
Miami, Fla.

The total of eight named tropical cyclones was below the past 30-yr average of nine for the fourth consecutive year. However, the six that became hurricanes equalled the 30-yr average and were the most in a single year since 1969. In addition, mariners had to contend with 26 hurricane days--the most since 1971--with the average intensity of the hurricanes also being the greatest since 1969. Figure 1 shows the tracks of the 1975 named tropical cyclones, and table 1 gives a statistical summary.

Hurricane Eloise was the most deadly and destructive Atlantic tropical cyclone of the season and the only one to make landfall in the United States. This was the fourth consecutive year with only one U. S. landfall of a named storm in contrast to a long-term average of over three.

Three of the named storms (Amy, Doris, Hallie) exhibited subtropical characteristics during some part of their life cycle, but only Doris was designated a subtropical storm before being named. Figure 2 shows the tracks of the subtropical portion of Doris and a late season subtropical storm, and table 2 gives a statistical summary of the two storms. Since aerial reconnaissance was not available for these storms, winds in these systems were estimated by a new technique for satellite classification of subtropical storms.

Four hurricanes, two tropical storms, and one subtropical storm affected the North Atlantic or United States East Coast shipping lanes, and two more hurricanes churned up Gulf of Mexico waters. Numerous ships encountered gales and high seas associated with the 1975 tropical and subtropical cyclones. Four ships reported winds of hurricane force. Table 3 lists those observations with gale or hurricane force winds which were received, plotted, and used during the issuance of advisories and bulletins. As always, the National Hurricane Center (NHC) greatly appreciates these observations which are fed right back into the wind and sea forecasts of the marine advisories.

Tables 4 and 5 present tropical cyclone statistics for past years. Summaries of extratropical portions of the tropical and subtropical cyclones, if severe, can be found in the appropriate Smooth or Rough Log.

Table 2.--Summary of North Atlantic subtropical cyclone statistics, 1975

No.	Dates	Maximum sustained winds (kn)	Lowest pressure (mb)
1 (Doris)	Aug 28-29	60	997
2	Dec 9-13	60	985

Table 1.--Summary of North Atlantic tropical cyclone statistics, 1975

No.	Name	Class	Dates	Maximum sustained winds (kn)	Lowest pressure (mb)	U.S. damage ($ millions)	Deaths
1	Amy	(T)	June 26-July 4	60	981		
2	Blanche	(H)	July 23-28	75	980		
3	Caroline	(H)	Aug 24-Sept 1	100	963		
4	Doris	(H)	Aug 28-Sept 4	95	965		
5	Eloise	(H)	Sept 13-24	110	955	550[1]	U. S. - 21 Puerto Rico - 34 Hispaniola - 25
6	Faye	(H)	Sept 18-29	90	977		
7	Gladys	(H)	Sept 22-Oct 3	120	939		
8	Hallie	(T)	Oct 24- 27	45	1002		

[1]Includes $60 million in Puerto Rico.

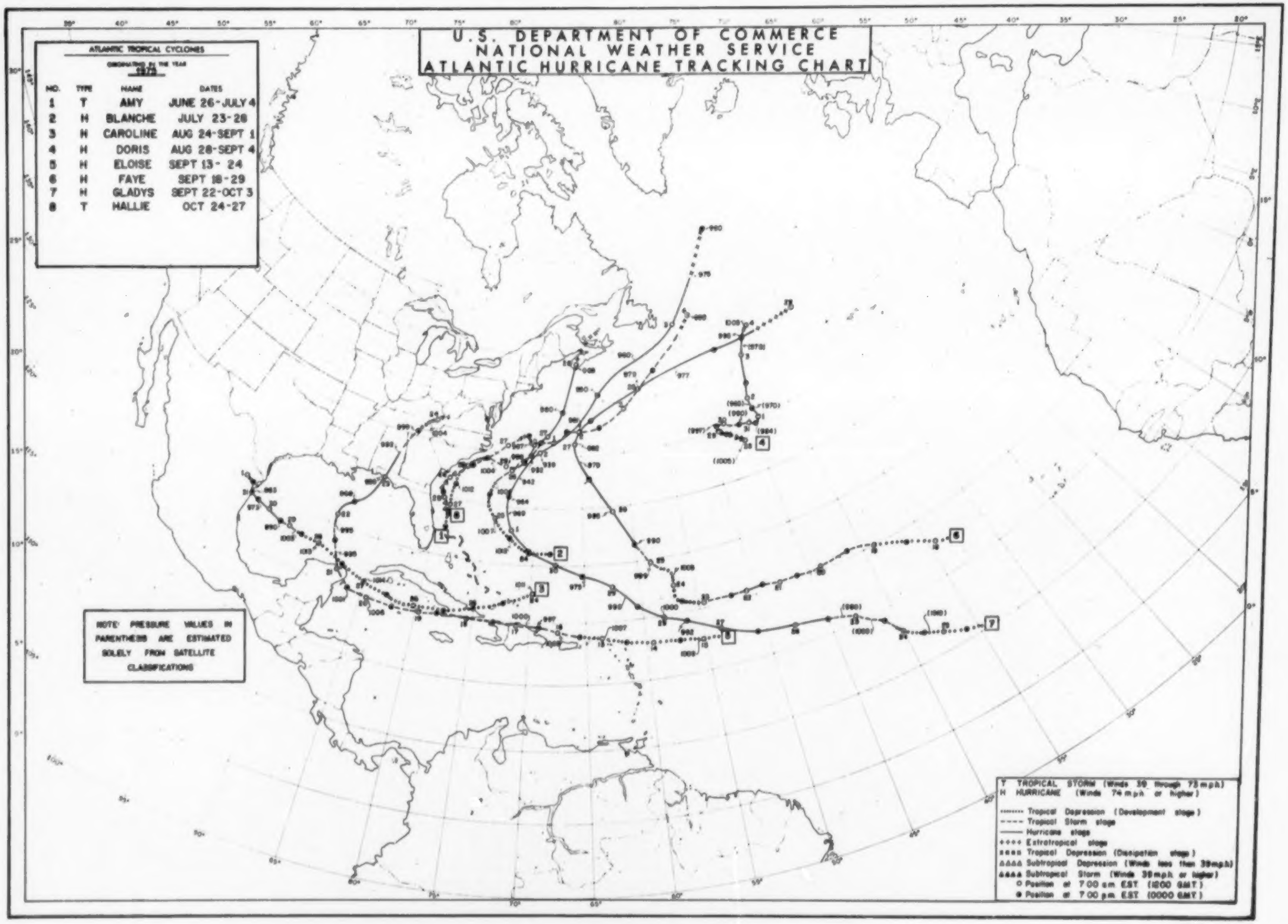


Figure 1.--Tracks of North Atlantic tropical cyclones, 1975.

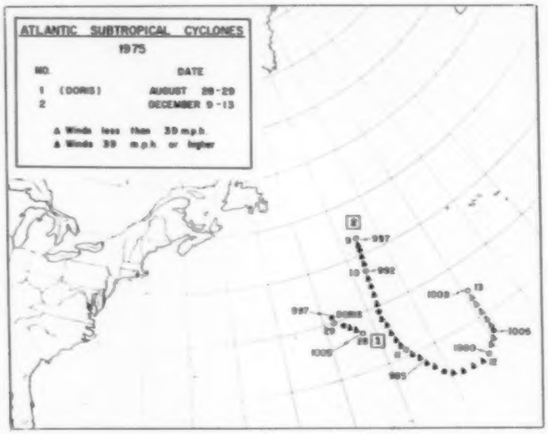


Figure 2.--Tracks of North Atlantic subtropical cyclones, 1975.

TROPICAL STORM AMY, JUNE 26 - JULY 4

Amy developed within a trough of low pressure which had persisted just off the southeast U. S. Coast for several days. The low-pressure system attained winds of gale force late on June 28 as the center was skirting the North Carolina outer banks. Winds gradually increased to a maximum of 60 kn on the 30th (fig. 3) as the storm meandered slowly away from the U. S. mainland. It accelerated rapidly northeastward on July 3 passing some 150 mi southeast of Cape Race, Newfoundland, on the 4th while becoming extratropical.

Among ships encountering Amy on June 30 were the SYLVO and BILDERDYK, which were to run into Faye and Gladys, respectively, later in the year. The highest wind reported by a ship during Amy was 55 kn encountered by the RODRIGUES CABRILHO on June 30.

During most of its life Amy had the characteristics of a subtropical storm. The region of maximum winds was well removed from the low-pressure center. The minimum central pressure of 981 mb occurred during this time. When winds reached gale force, however, data indicated it was more tropical than subtropical, so it was named Amy. Because of its close proximity to the coast, the name was retained throughout to avoid confusion in public releases. No attempt has been made to delineate the subtropical portions of this storm on the track charts.

Figure 3.--Tropical Storm Amy meandering slowly away from the United States on June 30.

HURRICANE BLANCHE, JULY 23-28

The depression which evolved into hurricane Blanche developed about 500 mi north of Hispaniola on July 23. It reached tropical storm strength, early on the 26th, while several hundred miles east of the U. S. mainland, as it was turning to the northeast ahead of an approaching cold front. However, the front weakened rapidly before cooler air could enter Blanche's circulation. Blanche reached hurricane strength during the early hours on the 27th. At this time the hurricane was at the same location crossed by tropical storm Amy 2 wk earlier.

As high pressure built over the western Atlantic, Blanche turned toward the north-northeast, reaching its minimum central pressure of 980 mb and maximum sustained winds of 75 kn late on the 27th (fig. 4). The hurricane weakened only slightly before striking the southern tip of Nova Scotia on the morning of July 28, becoming extratropical before reaching the Gulf of St. Lawrence at midday. Halifax, Nova Scotia, measured sustained winds of 45 kn with gusts to 70 kn and observed the "eye" of Blanche on radar. Damage was minor, and rainfall associated with Blanche was beneficial, ending a prolonged dry spell.

Gale warnings were issued from Rockland to Eastport, Maine, at midnight on the 28th, with the Canadian Weather Service issuing a hurricane warning for Nova Scotia.

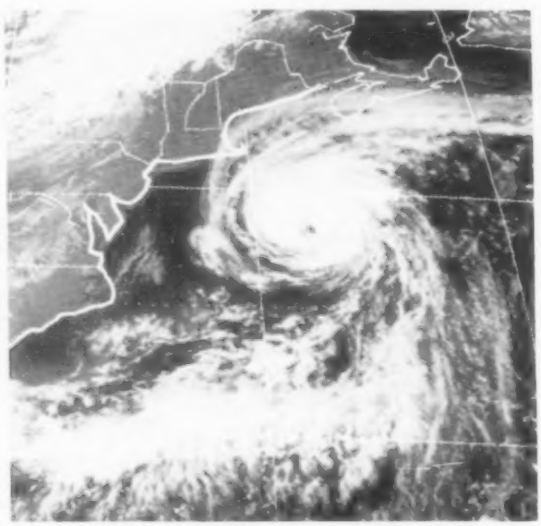


Figure 4.--Hurricane Blanche at maximum strength of 75 kn bearing down on Nova Scotia late on July 27.

Table 3.--Ships encountering tropical cyclones in the North Atlantic during 1975

Vessel	Nationality	Date	Position of Ship Lat. deg.°N	Position of Ship Long. deg.°W	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves† Period sec.	Sea Waves† Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.*	Swell Waves Height ft.
AMY		JUN															
SHIP		29	32.5	75.6	00	20	37										
EXXON HUNTINGTON	AMERICAN	29	34.6	74.0	12	03	50							15			
MAYAGUEZ	AMERICAN	29	32.5	73.3	12	19	40						3	8	20	≤ 5	10
SHIP		29	34.2	75.6	12	36	40										
BREUGHEL	BELGIAN	29	34.0	74.9	18	02	40						6	11	12	7	10
EXXON HUNTINGTON	AMERICAN	30	36.4	74.2	00	02	35						5	8	11	11	13
SYLVO	NORWEGIAN	30	36.0	74.1	12	36	35						8	13	10	8	8
RODRIGUES CABRILHO	PORTUGUESE	30	37.9	70.1	12	06	55			1004.0							
BILDERDYK	NETHERLANDS	30	38.1	70.5	12	08	40						6	10	08	9	13
MOBIL GAS	AMERICAN	30	34.0	75.5	18	02	40						5	6	10	9	10
MOBIL FUEL	AMERICAN	30	39.1	73.9	18	30	45						3	10	05	8	15
RODRIGUES CABRILHO	PORTUGUESE	30	38.1	71.9	18	04	45						7	13			
SHIP		30	37.5	71.5	18	05	40							20	06	≥14	20
USCGC ALERT	AMERICAN	30	38.6	74.7	18	01	35						8	3	02	6	6
BILDERDYK	NETHERLANDS	30	39.0	69.3	18	04	37						5	8	08	8	13
		JUL															
ANNA OULYANOVA	RUSSIAN	1	35.1	70.3	00	26	40			1002.1			8	20	32	13	16
JOHN TYLER	AMERICAN	1	35.9	66.8	00	16	36						5	13	18	8	25
USCGC ALERT	AMERICAN	1	37.3	75.3	06	03	52						5	6	04	6	16
USCGC DALLAS	AMERICAN	1	39.1	73.9	06	03	35						5	13			
ERIC K. HOLZER	AMERICAN	1	36.4	73.7	12	36	35						7	6	36	8	8
SYLVO	NORWEGIAN	1	37.6	71.8	12	01	40						8	16			
SILVRETTA	SWEDISH	1	34.3	66.9	12	20	38						9	20	20	9	20
MUENCHEN	GERMAN	1	35.0	65.4	12	20	37						4	6	x		8
AMSTEL PARK	NETHERLANDS	1	36.3	73.9	18	36	34						x	13	04	11	20
DART AMERICA	BRITISH	1	35.1	70.7	18	34	35						4	8	01	12	20
AFRICAN COMET	AMERICAN	1	33.2	67.6	18	23	35						3	10	35	≥14	10
C.V. STAGHOUND	AMERICAN	2	36.4	67.8	00	05	45						6	20	36	9	34
DART AMERICA	BRITISH	2	35.3	66.1	06	25	41			1004.0			5	18	30		20
DART AMERICA	BRITISH	2	35.5	63.9	12	19	50			1005.0			5	20	25	≤ 5	20
YTKK		2	35.2	68.4	12	25	37						4	5			
DART AMERICA	BRITISH	2	36.3	61.7	18	21	47						6	21	26		23
DART AMERICA	BRITISH	3	36.9	59.0	00	19	40						5	16	22		16
SHIP		3	36.9	50.0	00	20	45						5	16			
BLANCHE		JUL															
MITSUI MARU	JAPANESE	26	31.4	74.7	00	01	44						5	10	13	8	23
EMERILLON	BRITISH	26	35.1	69.8	18	16	40										
LIRCAY	CHILEAN	26	33.8	70.9	18	Gales											
EMERILLON	BRITISH	27	33.8	68.9	00	18	35										
CASTILO DE LA MOTA	SPANISH	27	37.2	67.5	12	13	35						4	13	24	9	11
STATENDAM	NETHERLANDS	27	36.7	69.6	15	35	40						5	6	05	11	15
MIECZYSLAW KALINOWSK	POLISH	27	37.7	69.5	18	36	35						7	13	04	8	13
TURANDOT	BELGIUM	27	38.8	68.0	18	14	37						5	6	19	12	16
IMPERIAL QUEBEC	CANADIAN	28	45.2	60.2	18	18	35										
CAROLINE		AUG															
RIO MARAPA	ARGENTINIAN	29	22.6	92.9	18	13	40						3	13			
SUBTROPICAL STORM NO. 1		AUG															
HAHNENTOR	GERMAN	28	36.0	47.2	18	08	37						6	10	08	11	21
HAHNENTOR	GERMAN	29	34.3	52.1	12	33	37						5	10	08	11	20
PROPONTIS	GERMAN	29	34.5	49.8	18	28	47			1000.5			7	11	28		11
DORIS		AUG															
HECTOR	BRITISH	30	36.4	48.3	06	09	35						4	18	12	8	21
IRISH MAPLE	IRISH	30	34.8	47.9	18	29	40						4	11	28	8	18
INNSTEIN	GERMAN	30	36.0	45.6	18	16	37						5	5	22	7	11
BENSTAC	BRITISH	30	35.2	46.8	18	19	45			1001.4			6	16	21	11	20
BENSTAC	BRITISH	30	33.9	47.0	21	23	60			995.0			6	41	24	13	33
INNSTEIN	GERMAN	30	35.7	46.4	21	16	35			1004.5			5	10	20	7	13
INNSTEIN	GERMAN	31	35.4	47.1	00	04	37			1003.0			6	10	x		13
BENSTAC	BRITISH	31	34.6	47.2	00	28	50			1004.1			6	41	27	12	33
WERA JACOB	GERMAN	31	35.4	42.8	18	15	34						6	13	26		13
ELOISE		SEP															
WESERMUNDE	GERMAN	17	20.8	71.6	12	09	47							10	08		13
POINTE D' COLIBRIS	FRENCH	17	18.0	68.5	12	10	35						6	16			
WESERMUNDE	GERMAN	17	21.1	72.0	15	09	47							10	09		13
BAYANO	BRITISH	21	20.7	85.6	12	17	35						5	13	18	8	20
DELTA NORTE	AMERICAN	21	23.2	86.7	12	12	35						12	16			
STOVE CAMPBELL	NORWEGIAN	21	23.3	86.4	22	11	36										
SHELDON LYKES	AMERICAN	22	28.3	91.0	12	02	35						5	10	09	≤ 5	10
ATLANTIC PRESTIGE	AMERICAN	22	26.2	88.4	12	13	60			998.3			8	25	12	11	41
HESS VOYAGER	AMERICAN	22	25.9	88.1	12	16	40			1000.0			6	10			
EXXON SAN FRANCISCO	AMERICAN	22	26.7	89.0	15	12	60			994.3			5	6	13	10	30
EXXON SAN FRANCISCO	AMERICAN	22	26.8	89.1	18	14	60			986.0			5	10	14	12	20
HESS VOYAGER	AMERICAN	22	25.8	87.6	18	19	45			1004.1			6	11	17	7	13
SEVERN BRIDGE	BRITISH	22	27.5	88.7	18	13	53			997.8			7	23	14	11	16
JALAKIRTI	INDIAN	22	27.5	91.0	18	01	35			1004.5							
EXXON SAN FRANCISCO	AMERICAN	23	26.9	88.8	00	29	70			979.0							
JALAKIRTI	INDIAN	23	28.8	89.0	00	01	55			1002.0			3	8	18	8	15
HESS VOYAGER	AMERICAN	23	25.5	85.8	00	19	40			1005.8			6	11	30	6	11
EXXON WASHINGTON	AMERICAN	23	25.8	86.4	00	18	40			1002.7			6	11			
PURE OIL	AMERICAN	23	28.3	84.2	00	16	34						9	6			
SHIP		23	27.9	87.7	00	12	35			996.8			6	13			
SHIP		23	29.1	87.1	06	11	43			990.6							
NSDT		23	24.7	83.0	06	18	40										
BARRANCA	BRITISH	23	27.5	90.5	09	29	40						2	6	35	7	11
NSDT		23	24.7	82.9	12	18	37							6-8			
T.L. LENZEN	LIBERIAN	23	28.1	86.1	12	22	40			1000.0			5	13	22	≤ 5	13

Table 3. (con't)--Ships encountering tropical cyclones in the North Atlantic during 1975

Vessel	Nationality	Date	Position of Ship Lat. deg.°N	Position of Ship Long. deg.°W	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves+ Period sec.	Sea Waves+ Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.*	Swell Waves Height ft.
FAYE		SEP															
LEMPA	HONDURAN	19	20.2	40.7	14	06	40						7	6	03	13	13
LEMPA	HONDURAN	19	20.4	40.4	18	07	40						6	20			
NOPAL TELLUS	NORWEGIAN	20	19.9	48.8	18	03	36						3	6	07	7	13
JASAKA	NORWEGIAN	21	20.6	40.8	06		34-40			1004.0							
BREMERHAVEN	GERMAN	25	25.5	57.4	00	10	37						6	8	13	7	10
BREMERHAVEN	GERMAN	25	24.3	59.4	06	09	37						7	10	06		10
BRUNSHAUSEN	GERMAN	25	26.2	54.2	12	14	37						7	8	14	7	10
MORMACRIGEL	AMERICAN	25	25.2	59.0	19	20	35			1005.2			5	8	20	9	20
BLEXEN	GERMAN	26	28.7	61.5	12	15	90			995.5				35			
ELSFLETH	GERMAN	26	31.3	62.0	12	07	36						6	10	7		13
ELSFLETH	GERMAN	26	31.9	61.5	15	08	35						6	10	8		13
BLEXEN	GERMAN	26	29.5	60.6	18	15	37						5	13	14	9	13
ELSFLETH	GERMAN	26	32.3	60.9	18	09	35							10	09		13
ELSFLETH	GERMAN	26	32.7	60.2	21	11	35						7	11	11	9	16
EA	SPANISH	27	38.2	62.8	18	13	35						10	16	13	12	16
HASSELBURG	GERMAN	28	37.1	64.9	00	26	50			1006.2			7	16	30	11	16
ZVIR	YUGOSLAVIAN	28	38.8	62.2	00	16	52			998.0							
ELIZABETHPORT	AMERICAN	28	39.5	59.1	00	17	35						5	11	17	6	11
KYOTO	BELGIAN	28	37.7	57.4	06	19	37										
ZVIR	YUGOSLAVIAN	28	38.7	62.9	06	16	44			1005.5							
ELIZABETHPORT	AMERICAN	28	37.5	58.8	09	23	45						6	15	23	7	15
SEALAND MARKET	AMERICAN	28	38.1	56.6	12	25	55						5	13	25	6	25
SHIP		28	39.6	56.1	12	25	34			998.9			8	38			
VALHALL	NORWEGIAN	28	40.4	53.7	15	18	52			1000.0							
VALHALL	NORWEGIAN	28	40.5	53.7	18	26	60			1004.0			12	23	26	11	26
SEVILLAN REEFER	LIBERIAN	28	40.7	51.0	18	21	50			999.0			x	23			
ELSFLETH	GERMAN	28	40.6	49.0	18	19	37			1004.0				10	19		10
HAR SINAI	ISRAELI	28	42.5	51.3	18	14	45			987.0			6	10	14	7	10
ELSFLETH	GERMAN	28	41.1	48.8	21	22	62			997.0			9	16	22	11	38
ELSFLETH	GERMAN	29	40.9	49.0	00	23	47			1002.0				16	23		20
SEVILLAN REEFER	LIBERIAN	29	40.5	51.2	00	27	40			1000.6			x	20			
AMERICAN ACCORD	AMERICAN	29	36.8	51.5	00	25	35							16	23		16
VALHALL	NORWEGIAN	29	40.7	53.0	00	28	35			1001.0			7	11	28	14	16
UKKN		29	44.5	46.2	00	10	45			995.5							
ELSFLETH	GERMAN	29	41.1	49.3	03	28	37			1004.3				13	25		20
SYLVO	NORWEGIAN	29	39.9	35.6	12	22	40						3	11	22	6	10
SYLVO	NORWEGIAN	29	39.6	36.4	18	24	55			1006.0			9	16	25	9	16
BLEXEN	GERMAN	29	38.3	35.8	18	23	37						6	13	33		10
GLADYS		SEP															
MARYMAR	AMERICAN	27	19.6	52.5	06	12	45						8	25	12	8	30
DELTA ARGENTIAN	AMERICAN	28	20.0	60.0	06	08	35						3	5	08	6	10
MISSISSIPPI	FRENCH	28	21.2	57.3	18	11	38						4	5	12	7	10
		OCT															
SHIP		1	29.6	73.0	12	05	35										
VEENDAM	NETHERLANDS	1	29.3	69.8	12	14	36						7	11	16	10	18
VEENDAM	NETHERLANDS	1	28.8	69.4	15	16	44						8	11	16	9	18
VEENDAM	NETHERLANDS	1	28.2	69.0	18	18	35						6	10	15	9	11
MARCONA TRADER	LIBERIAN	1	29.5	71.8	18	17	70			1006.7			12	10	17	12	15
CORNELIA MAERSK	DANISH	1	30.2	71.9	18	14	64			1004.5			12	43			
KIOC		2	30.9	70.9	00	19	40							16	19		20
EXXON SEATTLE	AMERICAN	2	33.8	71.8	12	31	45			1005.8							
SEA-LAND VENTURE	AMERICAN	2	34.1	68.0	12	18	50						5	11	18	8	13
UNION SUNRISE	FORMOSAN	2	35.9	66.2	18	18	60										
SEA-LAND VENTURE	AMERICAN	2	34.2	65.5	18	20	40							10	18	12	13
MORMACTRADE	AMERICAN	2	34.4	66.6	18	18	35						5	11	18	7	15
ASIA LINER	BRITISH	3	40.9	60.8	00	20	37			1006.2			4	16	24	7	13
ATLANTIC FOREST	NORWEGIAN	3	38.7	59.6	00	02	34							16	18		21
SHIP		3	35.3	64.1	00	20	36						6	8			
BILDERDYK	DUTCH	3	41.1	55.7	06	22	44			1007.5			7	13	18	7	11
USCGC GALLANTIN	AMERICAN	3	34.9	63.5	06	21	38						6	6			
ATLANTIC FOREST	NORWEGIAN	3	38.7	57.3	06	20	42							21	30		23
ATLANTIC FOREST	NORWEGIAN	3	38.8	55.2	12	20	38							20	22		22
ASIA LINER	BRITISH	3	41.3	54.9	12	23	40						4	16	23	7	20
NIVOSE	FRENCH	3	43.4	53.2	12	20	46			1006.0			3	20	23	6	41
AMERICAN ARCHER	AMERICAN	3	41.2	51.3	12	20	45						8	11	20	8	25
TROLL PARK	BRITISH	3	45.3	45.8	12	18	55						5	10	19	6	11
WESER EXPRESS	GERMAN	3	47.4	46.4	12	20	40						8	15			
HALLIE		OCT															
COLUMBUS ISELIN	AMERICAN	25	30.4	79.4	12	13	34			1008.0				13			
OAKLAND	AMERICAN	27	37.6	73.0	18	05	40						4	10	5	7	11
DART ATLANTIC	BRITISH	27	38.0	70.0	18	05	35						5	6			
SUBTROPICAL STORM NO. 2		DEC															
HAHNENTOR	GERMAN	9	37.7	46.6	12	29	35			1005.0			4	6	30	11	23
SHIP		10	39.5	43.2	12	32	60			995.0			6	13	31	6	13
KELKHEIM	GERMAN	11	36.2	41.8	00	12	35			999.5							
TOLOA	NETHERLANDS	11	29.0	45.4	18	36	40			1006.7			6	13	36	9	20
MERCHANT	BRITISH	11	28.5	41.6	18	16	25			987.6			4	3	28	10	20
GWKK		11	26.2	46.5	18	32	35						3	6	34	8	20

+ Direction of sea waves same as wind direction.
x Direction or period of waves indeterminate.

HURRICANE CAROLINE, AUGUST 24 - SEPTEMBER 1

Caroline developed from a tropical disturbance which left Africa on August 15 with a closed-wind circulation first appearing when the center was about 200 mi north of Hispaniola on August 24. The depression moved southwestward across eastern Cuba on the 25th. It gradually turned toward the west-northwest with no significant development during the next 3 days, moving into the Gulf of Mexico north of the Yucatan Peninsula by the 28th.

Satellite-determined cloud motions indicated the development of cirrus-level winds favorable for strengthening, and a reconnaissance plane found winds

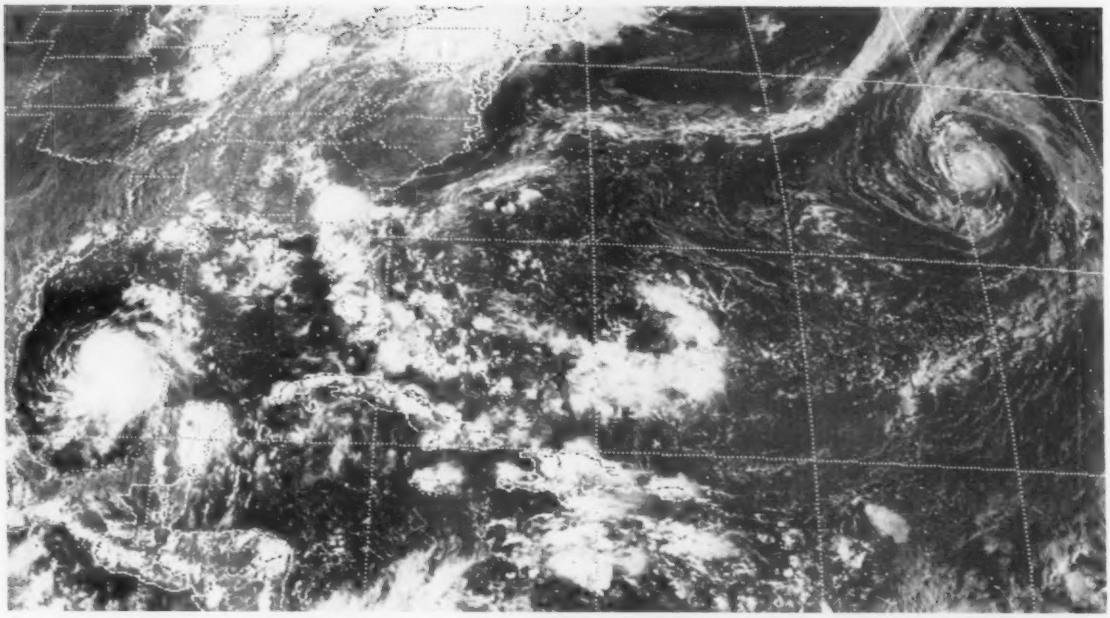


Figure 5. --Caroline on the verge of becoming a hurricane late on August 29. Subtropical Storm No. 1 is shown just prior to becoming tropical and designated Doris.

of tropical storm strength late on August 28. Caroline reached hurricane force about 24 hr later (fig. 5) and intensified rather rapidly beginning late on August 30, as it moved steadily west-northwestward. Landfall was about 100 mi south of Brownsville, Tex., on the morning of August 31. The minimum central pressure of 963 mb and maximum sustained winds of 100 kn were reported by reconnaissance aircraft several hours prior to landfall.

A hurricane watch was issued for the Brownsville area on the morning of the 30th, with interests along the northeast Mexican coast advised of the likelihood of hurricane conditions within 24 hr. Winds gusted briefly to gale force at Brownsville, and an aerial survey revealed several small communities along the northeast Mexican coast destroyed or badly damaged.

Because the intensification of Caroline took place in the sparsely travelled southwest Gulf of Mexico, the only ship to report winds of gale force was the RIO MARAPA on August 29.

HURRICANE DORIS (SUBTROPICAL STORM NO. 1) AUGUST 28 - SEPTEMBER 4

Hurricane Doris developed from a subtropical system in the mid-Atlantic. The initial low-pressure center developed from a frontal wave which formed, on August 27, near 31°N, 46°W. Satellite pictures showed the associated cloud mass was becoming more circular and detached from the front as the system deepened during the next 2 days. The HAHNENTOR reported gales, on the 28th and again on the 29th (fig. 5), when the system was designated a subtropical storm. That same day the PROPONTIS reported a westerly gale of 47 kn.

Satellite pictures, on the 30th, indicated the system was becoming tropical, and that afternoon the BENSTAC, passing just south of the center, reported southwesterly winds of 60 kn and seas of 40 ft. The system was designated hurricane Doris late that day, and by August 31 a well-defined eye appeared on satellite pictures. The minimum central pressure of 965 mb and maximum sustained winds of 95 kn in Doris occurred on September 2 and were based on satellite photograph evaluation. The system's center had meandered westward, then eastward, and slowly northward during the 5-day period of August 28 to September 2. It was only 250 mi from its starting point on September 2 (fig. 6). This slow movement, especially while Doris was a hurricane, enabled ships to easily avoid it; and no gale observations were received after August 31. On September 3, the hurricane moved northward ahead of a deepening low in the Canadian Maritime Provinces and lost all tropical characteristics early on September 4.

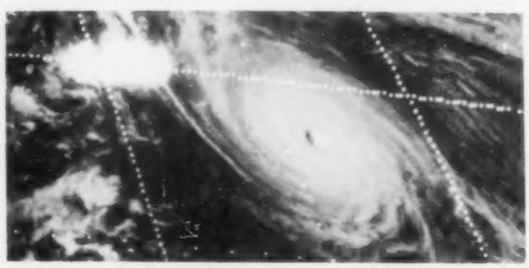


Figure 6. --Hurricane Doris at peak strength of 95 kn getting ready to move into North Atlantic shipping lanes.

Table 4

NORTH ATLANTIC TROPICAL CYCLONES FOR PAST YEARS

TOTAL NUMBER OF TROPICAL CYCLONES, LOSS OF LIFE AND DAMAGE								
	Total Number Tropical Cyclones*		Total Number Hurricanes		Loss of Life		Damage by Categories**	
Year	All Areas	Reaching U.S. Coast	All Areas	Reaching U.S. Coast	Total All Areas	United States	Total All Areas	United States
1931	9	2	3	0		0		6
1932	11	3	4	2		9		8
1933	21	7	9	5		63		7
1934	11	5	6	3		17		6
1935	6	2	5	2		414		7
	58	21	30	12				
1936	15	7	7	3		9		6
1937	8	4	3	0		0		4
1938	8	4	3	2		600		8
1939	5	2	3	1		3		8
1940	8	3	4	2		10		6
	46	21	20	8				
1941	6	4	4	2		10		7
1942	10	3	4	2	17	8	7	7
1943	10	4	5	1	19	16	7	7
1944	11	4	7	3	1,076	64	8	8
1945	11	5	5	3	29	7	6	8
	48	20	25	12				
1946	6	4	3	1	5	0	7	7
1947	9	7	5	3	72	53	8	8
1948	9	4	6	3	31	3	7	7
1949	13	3	7	2	4	4	8	8
1950	13	4	11	3	37	19	7	7
	50	22	32	12				
1951	10	1	8	0	311	0	7	6
1952	7	2	6	1	16	3	6	6
1953	14	6	6	2	3	2	7	7
1954	11	3	8	3	729+	193	9	9
1955	12	3	9	3	1,518+	218	9	8
	54	15	37	9				
1956	8	2	4	1	76	21	8	7
1957	8	5	3	1	475	395	8	8
1958	10	1	7	0	49	2	7	7
1959	11	7	7	3	57	24	7	7
1960	7	5	4	2	155	65	9	8
	44	20	25	7				
1961	11	3	8	1	345	46	9	8
1962	5	1	3	0	4	4	6	5
1963	9	1	7	1	7,310+	11	9	7
1964	12	6	6	4	295	49	9	9
1965	6	2	4	1	75	75	9	9
	43	13	28	7				
1966	11	2	7	2	1,040	54	8	7
1967	8	2	6	1	63	19	8	8
1968	7	3	4	1	11	9	7	7
1969	13	3	10	2	344	256	9	9
1970	7	4	3	1	74	11	9	8
	46	14	30	7				
1971	13	5	5	2	44	8	8	8
1972	4	2	3	1	122	121	9	9
1973	7	1	4	0	15	5	7	7
1974	7	1	4	1	8,000+	1	9	9
1975	8	1	6	1	80	21	9	9
Total	427	160	247	79				
Mean	9.3	3.6	5.5	1.8				

**The Environmental Data Service has for some time recognized that, without detailed expert appraisal of damage, all figures published are merely approximations. Since errors in dollar estimates vary in proportion of the total damage, storms are placed in categories varying from 1 to 9 as follows:

1 Less than $50
2 $50 to $500
3 $500 to $5,000
4 $5,000 to $50,000
5 $50,000 to $500,000
6 $500,000 to $5,000,000
7 $5,000,000 to $50,000,000
8 $50,000,000 to $500,000,000
9 $500,000,000 to $5,000,000,000

*Including hurricanes
• Not reported in literature, believed minor.
+ Additional deaths for which figures are not available.

HURRICANE ELOISE, SEPTEMBER 13-24

The disturbance from which Eloise formed left the African coast on September 6. The first sign that a depression had formed came, on September 13, when the GULF HANSA reported northerly winds of 20 kn and seas of 10 ft. The GULF HANSA moved parallel to the track of Eloise from the African coast to the Gulf of Mexico at the same speed, but never encountered gales and managed to beat Eloise to port.

Satellite pictures and ship and reconnaissance reports indicated slow intensification during the next 48 hr, and winds reached tropical storm strength early on September 16. Eloise now intensified rapidly, and NOAA reconnaissance aircraft reported winds of minimal hurricane strength before it struck the northeastern coast of the Dominican Republic late that day. However, the main loss of life in Eloise resulted from flash floods caused by torrential rains over Puerto Rico, the Dominican Republic, and Haiti. Bulletins and advisories had warned of the impending disaster from the heavy rains more than 24 hr in advance. Fifty-nine deaths occurred in that area, with 34 in Puerto Rico; and damage was estimated at $60 million. Rainfall amounts of 10-20 in were common over eastern and southwestern Puerto Rico with the maximum of 26.7 in near Sabana Grande in southwestern Puerto Rico.

The circulation of Eloise weakened considerably during the next 2 days as the center tracked westward across the mountainous terrain of Hispaniola and extreme eastern Cuba. By the 19th, Eloise was barely a tropical storm tracking westward toward the Yucatan Channel. Few storms fail to intensify as they move through the Yucatan Channel into the Gulf of Mexico, and Eloise was no exception. An approaching upper-level trough in the westerlies caused Eloise to turn to the north after crossing the Yucatan Peninsula just north of Cozumel, Mexico. Eloise began a steady strengthening north of the Yucatan Peninsula, regaining hurricane force in the central Gulf of Mexico about 350 mi south of New Orleans on the morning of September 22. Numerous ships were caught in gale-force winds as the hurricane grew in size and strength and moved through the main Gulf shipping lanes during the next 24 hr. However, the EXXON SAN FRANCISCO caught the brunt of Eloise's fury while passing through the center, on the 22d, as sustained winds reached 75 kn with gusts to 90 kn, and the pressure fell to 971.5 mb about 2300 on the 22d. Figure 7 reproduces the pressure and wind records of the EXXON SAN FRANCISCO which were sent to the National Hurricane Center.

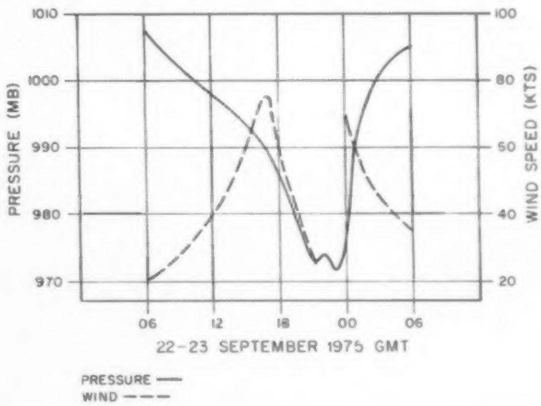


Figure 7. --Reproduction of the pressure and wind observations of the EXXON SAN FRANCISCO while passing through Eloise on September 22-23, 1975.

The center of Eloise passed within 17 mi of buoy EB04 with the western fringe of the eye over the buoy between 1300 and 1400. During this time, the buoys were reporting hourly (fig. 8). At 0300 on the 23d, the eye passed over EB10 with the center within 10 mi of the buoy. The minimum pressures recorded by the buoys were 986.7 mb at EB04 and 967.8 mb at EB10. The maximum winds were 52 kn (EB04) and 68 kn (EB10). The buoy EB10 reported a 29-ft significant wave height. (See buoy data summary on page 107.)

The hurricane continued strengthening until landfall (fig. 9) about midway between Fort Walton Beach and Panama City, Fla., shortly after 1200 on September 23. It was the first direct hit by a major hurricane in that area in the 20th century! As Eloise moved inland over eastern Alabama at a forward speed of 25 kn, cooler air was drawn into its circulation, and it weakened to a tropical depression over extreme eastern Tennessee only 12 hr after landfall.

The lowest pressure of 955 mb was observed at

Table 5

NORTH ATLANTIC TROPICAL CYCLONES FOR PAST YEARS

Frequency of Tropical Cyclones (Including Hurricanes) by Months and Years

		May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1931			1	1	2	3	1	1		9
1932		1			3	3	3	1		11
1933		1	1	3	7	5	3	1		21
1934		1	1	1	2	2	3	1		11
1935					3	1	2			6
1936			3	2	6	4	1			16
1937				1	2	6				9
1938					3	1	3	1		8
1939			1		1	1	2			5
1940		1			3	2	2			8
1941						4	2			6
1942					3	3	3	1		10
1943				1	2	4	3			10
1944				3	2	4	2			11
1945			1	1	4	3	2			11
1946			1	1	1	1	2			6
1947				1	2	3	3			9
1948		1		1	2	3	1	1		9
1949					3	7	2	1		13
1950					4	3	6			13
1951		1			3	4	2			10
1952	(Feb.) 1				2	2	2			7
1953		1			3	4	4	1	1	14
1954			1	1	2	4	1	1	1	11
1955				1	4	5	2			12
1956			1	1	1	4	1			8
1957			2		1	4	1			8
1958			1		4	4	1			10
1959		1	2	2	1	3	2			11
1960			1	2	1	3				7
1961				1		6	2	2		11
1962					2	2	1			5
1963				1	1	5	2			9
1964			1	1	4	4	1	1		12
1965			1		2	2	1			6
1966			1	4	1	4		1		11
1967					1	4	3			8
1968			3		1	2	1			7
1969				1	6	2	3	1		13
1970		1		2	1	3				7
1971				1	3	6	1	1		12
1972			1		2	1				4
1973				1	2	2	2			7
1974					3	4				7
1975			1	1	2	3	1			8
Totals	(Feb) 1	9	25	36	106	150	80	16	2	427

Frequency of Tropical Cyclones Reaching Hurricane Intensity by Months and Years

	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1931					2				2
1932				3	1	1	1		6
1933		1	1	3	3	1			9
1934		1	1	1	1	1	1		6
1935				2	1	2			5
1936		1	1	3	2				7
1937					3				3
1938				2	1				3
1939				1		2			3
1940				3	1				4
1941					3	1			4
1942				3			1		4
1943			1	1	2	1			5
1944			2	1	3	1			7
1945		1		1	1	2			5
1946			1		1	1			3
1947				2	1	2			5
1948				1	3	1	1		6
1949				2	4	1			7
1950				4	3	4			11
1951	1			2	3	2			8
1952				2	2	2			6
1953				2	3	1			6
1954		1		2	3	1		1	8
1955				3	5	1			9
1956			1	1	1	1			4
1957		1			2				3
1958				3	3	1			7
1959		1	2		3	1			7
1960			1	1	2				4
1961			1		5	1	1		8
1962				1	1	1			3
1963			1	1	4	1			7
1964				2	3	1			6
1965				2	1	1			4
1966		1	3	1	1		1		7
1967				1	3	2			6
1968		2		1		1			4
1969				5	2	2	1		10
1970	1		1		1				3
1971				1	4				5
1972		1		1	1				3
1973			1	1	1	1			4
1974				2	2				4
1975			1	2	3				6
	2	11	19	70	95	42	7	1	247

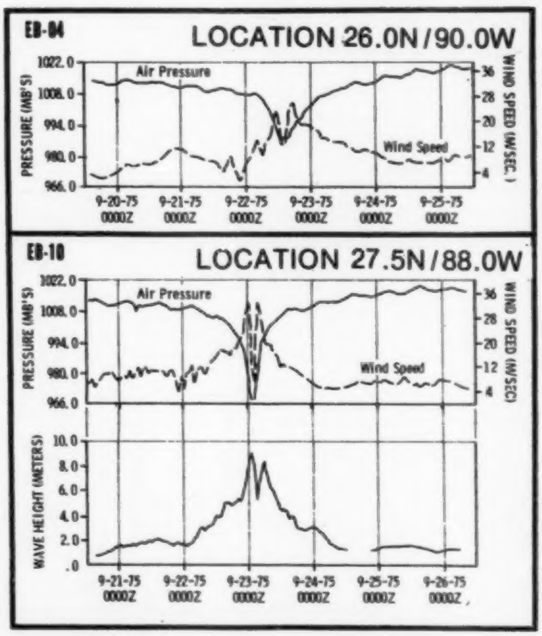


Figure 8.--Time series of the sea-level pressure, wind speed, and wave heights for buoys EB04 and EB10 during the passage of hurricane Eloise.

Table 6.--Tropical Cyclone Data, Hurricane Eloise, September 13-24, 1975

Station	Date	Pressure (inches)		Wind (miles per hour)				Highest Tide (feet) MSL		Storm Rainfall (inches)
		Low	Time•	Fastest Mile	Time•	Gusts	Time•		Time•	
FLORIDA										
Apalachicola WSO	23	29.47	0456	SW 40	0647	SW 53	0436#	4.7	0607	0.12
Bahama Beach	23							16.0		
Blountstown	23					45-50*	0630			
Cedar Key	23					41	0800	3.0		
Crestview FAA	23	29.02	0600			N 81	0641			9.48
Destin	23	28.20						10.6		
Dune Allen Beach	23							13.0		
Mexico Beach	23							11.6		
Panama City (Tyndall AFB)	23	29.23		SE 55	0723	SSE 76	0743			0.74
Panama City FAA	23					70*	0640*			
Panama City (13 nm south—60-ft tower)	23					103				
Panama City Beach	23							14.9		
Pensacola FAA	23	29.15	0605	N 38	0627	NNW 50	0628	1.9	1200	5.62
Sunnyside	23							16.3		
Tallahassee WSO	23	29.05	0620#	S 35	0609	S 46	0610			0.91
Valparaiso (Eglin AFB)	23	29.30		61[1]		113[1]				14.90
Valparaiso (Hurlburt Field)	23	28.69		67		85				13.74
ALABAMA										
Anniston FAA	23	29.15	1230			N 30	1210			4.77
Auburn ESSC	23	29.10	1030			74	1030			2.62
Birmingham WSFO	23	29.48	1207	NW 26	1200	N 35	1215			2.93
Dauphin Island	23	29.55	0430	N 39	0120	N 54	0130#			5.22
Dothan FAA	23	29.18	0800	ESE 52	0800	ESE 80	0900			1.00
Huntsville	23	29.52	1410#	N 28	1410#	N 40	1346			3.41
Mobile WSO	23	29.54	0630			N 37	22/2351#			1.74
Montgomery WSO	23	29.15	1044	NW 42	1046	NW 64	1040			5.54
Ozark (5 NW)	23			104	0855	130	0855			
Ozark (Fort Rucker)	23	28.95		S 46	0800	S 92				2.38
GEORGIA										
Atlanta WSFO	23	29.30	1300	S 42	1304	S 59	1315			0.58
Columbus WSO	23	29.04	1006	ESE 35	1036	SE 61	1115			0.44
LOUISIANA										
Boothville WSMO	23	29.64	0545			30	22/2245			4.72
Buras	22					75-80				
New Orleans WSFO	22	29.72	22/0330	N 30	2353	N 46	1743			
New Orleans FAA	23					59				
MISSISSIPPI										
Bay St. Louis	23	29.75	0545			N 40	22/2000			0.72
TENNESSEE										
Chattanooga WSO	23	29.36	1455			NE 32	1455			3.30

[1] Instrument failed
•Central Standard Time
#First of several occurrences
*Estimated

Figure 9.--These damaged sailboats stacked like toys show the wrath of Eloise. Wide World Photo.

Destin, Fla. Maximum sustained winds were estimated at 110 kn. However, the highest sustained winds along the coast went unmeasured because of the sparseness of observing stations and the failure of wind measuring equipment. A sustained wind near 80 kn with a gust to 135 kn was measured on a 98-ft tower located 13 mi offshore from Panama City. Winds of hurricane force were reported from Fort Walton Beach to Panama City and northward into extreme southeastern Alabama. Gales were reported from the southeastern Louisiana Delta and New Orleans area to Cedar Key, Fla., and northward over most of Alabama and western Georgia into extreme southeastern Tennessee.

Rainfall amounts ranged from 4 to 8 in from extreme southeastern Louisiana to the Panama City area and over extreme western portions of the Carolinas. The greatest storm total was 14.9 in at Eglin Air Force Base in Valparaiso.

Measurements of high-water marks by the U. S. Corps of Engineers, Mobile District, indicate hurricane tides of 12 to 16 ft above mean sea level occurred from just east of Fort Walton Beach to south of Panama City. The highest inside high-water mark of 18.2 ft occurred near Dune Allen Beach. Reports indicate that at least ten tornadoes occurred from northwestern Florida to western North Carolina, causing minor damage and no deaths. Table 6 summarizes the significant meteorological data. Measurements are given in the units in which they were reported.

By late on the 24th, Eloise's remnants were no longer identifiable. However, the combination of the moisture brought northward by Eloise and a stagnant frontal zone produced rainfall amounts of 5 in or more over eastern Virginia, extreme eastern West Virginia, Maryland, New Jersey, eastern Pennsylvania, and southern New York State. Storm totals exceeded 10 in along some of the eastern mountain slopes, triggering major flooding on the Chemung, Susquehannah, Potomac, and Shenandoah Rivers.

The combined effects of winds and tides undermined or demolished numerous structures along the beach strip from Fort Walton to Panama City. Losses will probably exceed $100 million. Four deaths were indirectly attributed to Eloise. Damaging winds over eastern Alabama caused extensive damage to property and crops with losses estimated near $100 million. Over the northeastern U. S., flooding damage was estimated at about $300 million with 17 deaths, most of which were drownings (fig. 10).

Figure 10.--Flood waters from Loyalsock Creek, east of Williamsport, Pa., forced families to evacuate their homes. Wide World Photo.

HURRICANE FAYE, SEPTEMBER 18-29

Satellite pictures first indicated the formation of the depression which developed into Faye about 500 mi west of the Cape Verde Islands on September 18. On the 19th, ship reports from the LEMPA indicated the depression had strengthened to a tropical storm. Faye moved steadily westward with little change in strength until September 23 at which time unfavorable cirrus-level winds caused the storm to weaken to a depression. The depression drifted northward and then westward during the next 48 hr. Cirrus-level winds became more favorable by the 25th, and Faye regained tropical storm and then hurricane strength while beginning a northwesterly course that would continue until the 27th.

The center passed just east of Bermuda on the evening of the 26th (fig. 11), but damage on the Island was minor since it remained on the weak side of the hurricane. Earlier that day the BLEXEN sent a plain language message indicating the ship was very close to the center and experiencing 90-kn winds and 35-ft seas. Meanwhile, the ELSFLETH reported 35-kn gales throughout the day while heading north-northeastward and probably unaware that 48 hr later the ship would meet Faye again and endure 62-kn winds and 38-ft seas as the hurricane recurved and accelerated east-northeastward. Several other ships reported winds of 55-60 kn, on the 28th, including the SEALAND MARKET, VALHALL, and SEVILLAN REEFER.

Faye lost tropical characteristics, on the 29th, but still packed plenty of punch as the SYLVO, which had earlier battled Amy, reported 55-kn winds while located about 200 mi west of the Azores. The lowest pressure reported in Faye was 977 mb and the highest wind 90 kn.

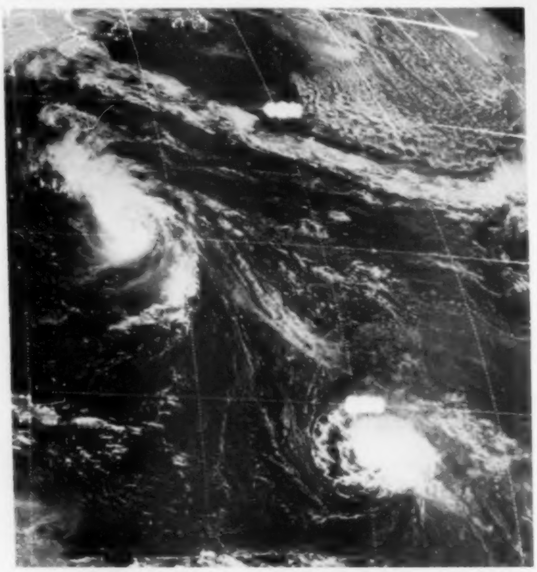


Figure 11.--Hurricane Fay bearing down on Bermuda on September 26 with hurricane Gladys trailing several hundred miles to the southeast.

HURRICANE GLADYS, SEPTEMBER 22 - OCTOBER 3

The disturbance from which Gladys evolved followed the one from which Faye formed by about 4 days. Faye took a more northerly track along latitude 20°N, while Gladys followed to the southeast along latitude 11°N. Like Faye, Gladys reached tropical depression status near longitude 35°W and tropical storm strength near longitude 40°W. However, Gladys was able to reach hurricane intensity before encountering the same unfavorable conditions that Faye had between 45°-55°W.

After weakening to a marginal hurricane by September 28, Gladys began intensifying while following a rather typical track around the Atlantic subtropical ridge. As the hurricane turned to a northerly track slightly sooner than anticipated on October 1, the MARCONA TRADER and CORNELIA MAERSK reported hurricane-force winds of 70 kn and 64 kn, respectively. Twenty-four hours later at 1800 on October 2, the UNION SUNRISE reported southerly winds of 60 kn as reconnaissance aircraft measured a central pressure of 939 mb and 120-kn winds about 300 mi east of Cape Hatteras, N. C. This is one of the lowest recorded pressures in a hurricane that far north.

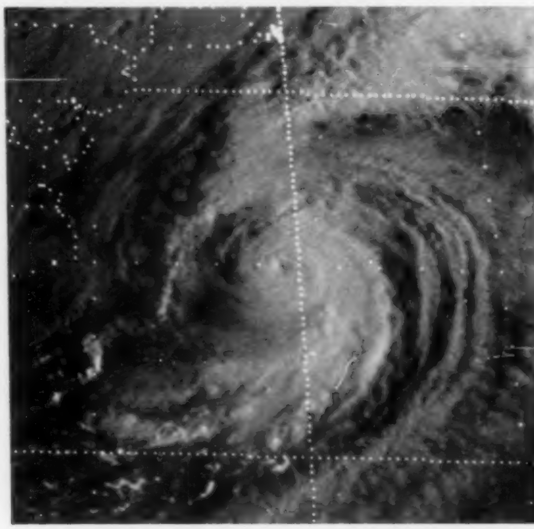


Figure 12.--Hurricane Gladys early on October 2 when the central pressure was 939 mb.

Gladys turned toward the northeast and accelerated on the 2d (fig. 12), moving at a forward speed of better than 45 kn, as it passed about 70 mi off Cape Race, Newfoundland, around daybreak on the 3d. Widespread gales covered the western Atlantic as Gladys merged with a strong cold front, and all of the ship's observations with gale force on this day have not been logged in table 3. However, one ship which reported 44-kn winds early that day was the BILDERDYK, which had run into tropical storm Amy about 400 mi to the west just 3 mo earlier.

The following encounter with Gladys was extracted from the ship's log and barograph trace (fig. 13) of the MARACAIBO. The times are local zone time.

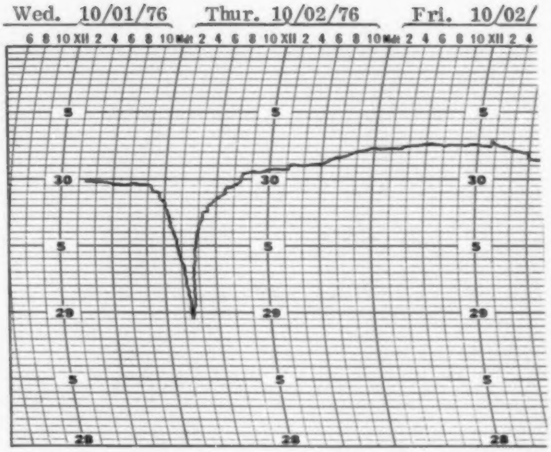


Figure 13.--The barograph trace from the MARACAIBO during its encounter with Gladys.

On October 1 at 2400 hr LZT vessel on course 120° at 10 kn at 32°53'N, 71°40'W, barometer 1006 mb, wind SE force 8, overcast.

10/2/75 0100 hr, barometer 1000 mb, heavy seas.

10/2/75 0200 hr, barometer 996 mb, wind force 10, anemometer failed, sea state 8.

10/2/75 0300 hr, barometer 992 mb, wind force 11, sea 9, heavy rain, unable to steer.

10/2/75 0330 hr, barometer 980 mb, wind force 12, sea 9, heavy rain, pressure started to rise.

10/2/75 0400 hr, barometer 1002 mb, wind SSW, force 10, sea 8, change course to 180°, visibility 1/2 mi, heavy rain.

10/2/75 0500 hr, barometer 1004 mb, wind shifting to starboard.

TROPICAL STORM HALLIE, OCTOBER 24-27

Hallie developed from a subtropical depression which had originated on October 24 in an old frontal zone off the Florida East Coast. The depression moved slowly northward parallel to and within 100 mi of the Florida and Georgia coastline, gradually acquiring tropical characteristics during this time. It reached tropical storm strength about 100 mi east of Charleston, S. C., on October 26 (fig. 14). The storm turned northeastward that evening, reaching maximum intensity of 45 kn and minimum pressure of 1002 mb while skirting the North Carolina outer banks. Gale warnings were issued for the outer banks, but the area remained on the weak side of the storm. However, a severe thunderstorm caused wind gusts estimated in excess of hurricane force at Frying Pan Lightship. Hallie merged with a frontal zone and became extratropical late on the 27th.

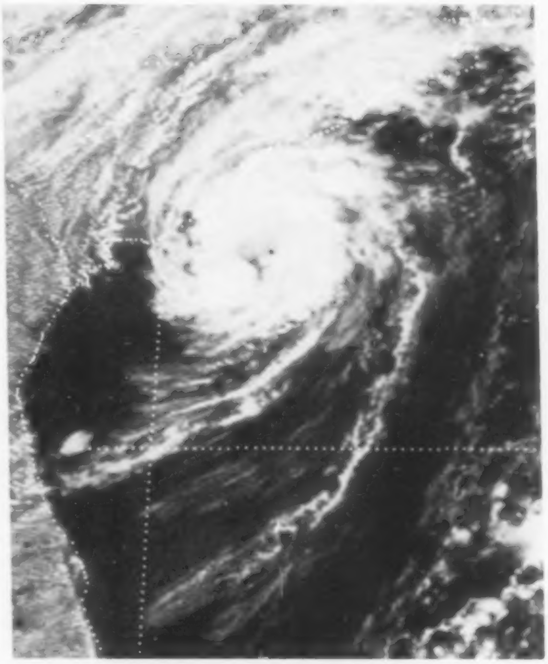


Figure 14.--Hallie just after reaching tropical storm strength around midday on October 26.

SUBTROPICAL STORM NO. 2, DECEMBER 9-13

A late season storm which evolved from an extratropical storm in the north central Atlantic exhibited characteristics of a subtropical system by December 9. The storm followed a rather unusual track, moving southward at 25 kn, between the 10th and 11th, before curving eastward and weakening rapidly on the 12th. An unidentified ship reported northwesterly winds of 60 kn as the low intensified on the 10th. The HAHNENTOR had the rather dubious distinction of encountering Subtropical Storm No. 2 at almost the exact spot where the ship had run into Subtropical Storm No. 1 (Doris) 3-1/2 mo earlier!

ACKNOWLEDGEMENT

Portions of the narrative on the individual storms are based on preliminary reports by other hurricane forecasters at Miami, New Orleans, and San Juan.

REFERENCES

Herbert, Paul J., "Subtropical Cyclones," Mariners Weather Log, Vol. 17, No. 4, Wash., D. C., July 1973.

Herbert, Paul J. and Kenneth O. Poteat, "A Satellite Classification Technique for Subtropical Cyclones," NOAA Tech. Memo NWS SR-83, Fort Worth, Tex., July 1975.

WEATHER AND MARITIME CASUALTY STATISTICS

Robert G. Quayle
National Climatic Center
Asheville, N. C.

The grizzly specter of maritime disaster has often darkened the pages of the Mariners Weather Log. The ever present threat posed by the untamed elements has been both albatross, ever tugging at the seafarer's subconsciousness, and mystique, adding glamour and romance to the seaman's profession. But for all the anecdotes, articles, pictures, movies, and news accounts, very little long-term statistical information has been publicized. The American Institute of Marine Underwriters (1974) offered some financial information, but no summaries were available. Comprehensive casualty statistics for U. S. commercial vessels have been compiled by the Coast Guard since 1946. These reports, which are published in Proceedings of the Marine Safety Council (formerly the Merchant Marine Council), were expanded in 1964 to include considerably more detail.

Tables 7 through 11 have been summarized from the Coast Guard casualty statistics for the 10-yr period 1964-73. These reports are generally received from U. S. commercial vessels (including fishing and inland types) whenever a casualty results in any of the following:

(a) Actual physical damage to property in excess of $1,500.
(b) Material damage affecting the seaworthiness or efficiency of a vessel.
(c) Stranding or grounding (with or without damage).
(d) Loss of life.
(e) Injury causing any persons to remain incapacitated for a period in excess of 72 hr (except injury to harbor workers not resulting in death and not resulting from vessel casualty or vessel equipment casualty).

The term "weather-related casualty" in tables 7-11 could well be interpreted "weather-induced casualty," since weather was given as the primary causal factor in all instances. It will be seen later that a great many more casualties, while not directly weather induced, were probably related to weather. When interpreting the tables, it is necessary to differentiate between a casualty, which is an individual event that may involve more than one vessel, and the vessel count, which indicates the number of vessels involved. Total percentages may not add algebraically because of rounding.

Tables 7 and 8 indicate that, while heavy weather casualties are more numerous than fog casualties, more ships are damaged in fog (because more than one ship is often involved in a single casualty).

Table 7. --Weather-related casualties as a percent of all casualties for U. S. vessels (U. S. Coast Guard, 1964-73)

Type of casualty	Number of casualties	Percent of total
Collision, fog	319	1.2
Heavy weather damage	606	2.3
Fog and heavy weather (total)	925	3.6
Total (all causes)	25,999	100.0

Table 8. --Number of U. S. vessels involved in weather-related casualties by type of casualty and displacement (U. S. Coast Guard, 1964-73)

Type of casualty/ship displacement (gross tonnage)		Number of ships	Percent of total (% of 39,792)	Percent of all causes for each displacement class
	< 300	312	0.8	1.8 (of 17828)
Collision, fog	300-1000	155	0.4	2.1 (of 7266)
	1000-10,000	224	0.6	2.3 (of 9868)
	> 10,000	119	0.3	2.5 (of 4830)
	Total	810	2.0	
	< 300	224	0.6	1.3 (of 17828)
Heavy weather	300-1000	32	0.1	0.4 (of 7266)
	1000-10,000	212	0.5	2.1 (of 9868)
	> 10,000	193	0.5	4.0 (of 4830)
	Total	661	1.7	
Fog and	< 300	536	1.3	3.0 (of 17828)
heavy weather	300-1000	187	0.5	2.6 (of 7266)
	1000-10,000	436	1.1	4.4 (of 9868)
	> 10,000	312	0.8	6.5 (of 4830)
	Total	1471	3.7	
	< 300	17,828	44.8	100.0
Total	300-1000	7,266	18.3	100.0
(all causes)	1000-10,000	9,868	24.8	100.0
	> 10,000	4,830	12.1	100.0
	Total	39,792	100.0	

Table 9. --Distribution of percent of weather-related casualties for U. S. vessels by displacement class. Comparison with the last column will indicate if the cause is more frequent than the total (average) or less frequent for each displacement class (U. S. Coast Guard, 1964-73)

	Percent of ships involved in casualties (based on displacement class)			
Ship displacement (gross tonnage)	Collision, fog	Heavy weather damage	Fog and heavy weather	Total (all causes)
< 300	38.6	33.9	36.4	44.8
300-1000	19.1	4.8	12.7	18.3
1000-10,000	27.7	32.1	29.6	24.8
> 10,000	14.7	29.2	21.2	12.1
Total	100.0	100.0	100.0	100.0

Table 9 shows that weather-related casualties are more common among larger ships, particularly heavy-weather casualties. While only 12.1 percent of all ships involved in casualties were over 10,000 tons,

Table 10. --Number of deaths and injuries resulting from weather-related casualties to U. S. vessels (U. S. Coast Guard, 1964-73)

Type of casualty	Number of deaths/injuries	Percent of total deaths/injuries
Collision, fog	40/43	2.2/3.5
Heavy weather	20/13	1.1/1.1
Fog and heavy weather	60/56	3.3/4.6
Total (all causes)	1803/1214	100.0/100.0

Table 11. --Number of weather-related casualties for U. S. vessels resulting in death or injury (U. S. Coast Guard, 1964-73)

Type of casualty	Number of casualties with death or injury	Percent of total
Collision, fog	37	3.0
Heavy weather	16	1.3
Fog and heavy weather	53	4.3
Total (all causes)	1244	100.0

29.2 percent of all heavy-weather casualties befell ships of this class. The reasons: larger ships ply the open ocean areas where communications can be poor, where the elements can be more ferocious, and where havens are not close by.

Comparison of tables 7 and 8 with 10 and 11 shows that while fog accounts for only 1.2 percent of all casualties and 2 percent of all ships involved in casualties, it claims 2.2 percent of the lives, 3.5 percent of the injuries, and causes 3 percent of the casualties involving life and limb. Heavy weather seems to be somewhat less of a threat than poor visibility when viewing these statistics.

Many other inferences can be drawn from these tables. Such information should help point out where particular attention should be focused for various types of operations.

Although the Coast Guard statistics are highly valuable, worldwide information was desired to provide a broader perspective. The American Institute of Marine Underwriters informed us that Lloyds of London reports an average of some 200 casualties weekly, covering everything from the first-class matron falling down a ladder and bruising her pride to the sinking of the Titanic. These would obviously have been too voluminous for our purposes, so we settled upon the excellent Liverpool Casualty Returns published monthly by the Liverpool Underwriters' Association. These returns contain information on most major casualties (fig. 15) involving ships of 500 gross tons and over. Data were summarized in general terms from these reports for the period 1960-73. More detailed summaries were prepared for the 10-yr period 1964-73.

Figure 15.--The badly listing British freighter AMBASSADOR is sinking in 25-ft seas. The USCGC COOS BAY is attempting to rescue the crew. Of a crew of 35, 20 survived this sinking. U. S. Coast Guard Photo.

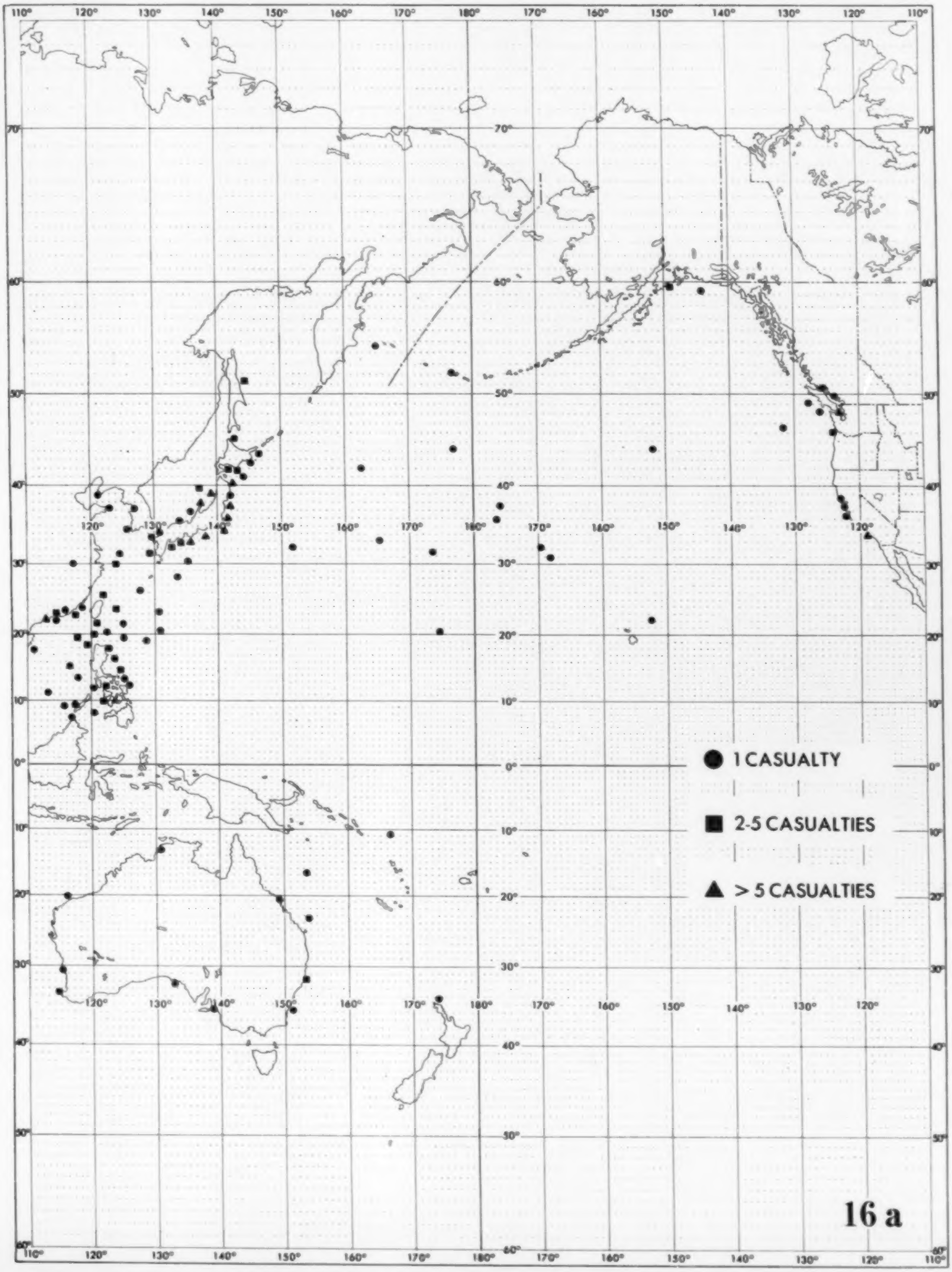
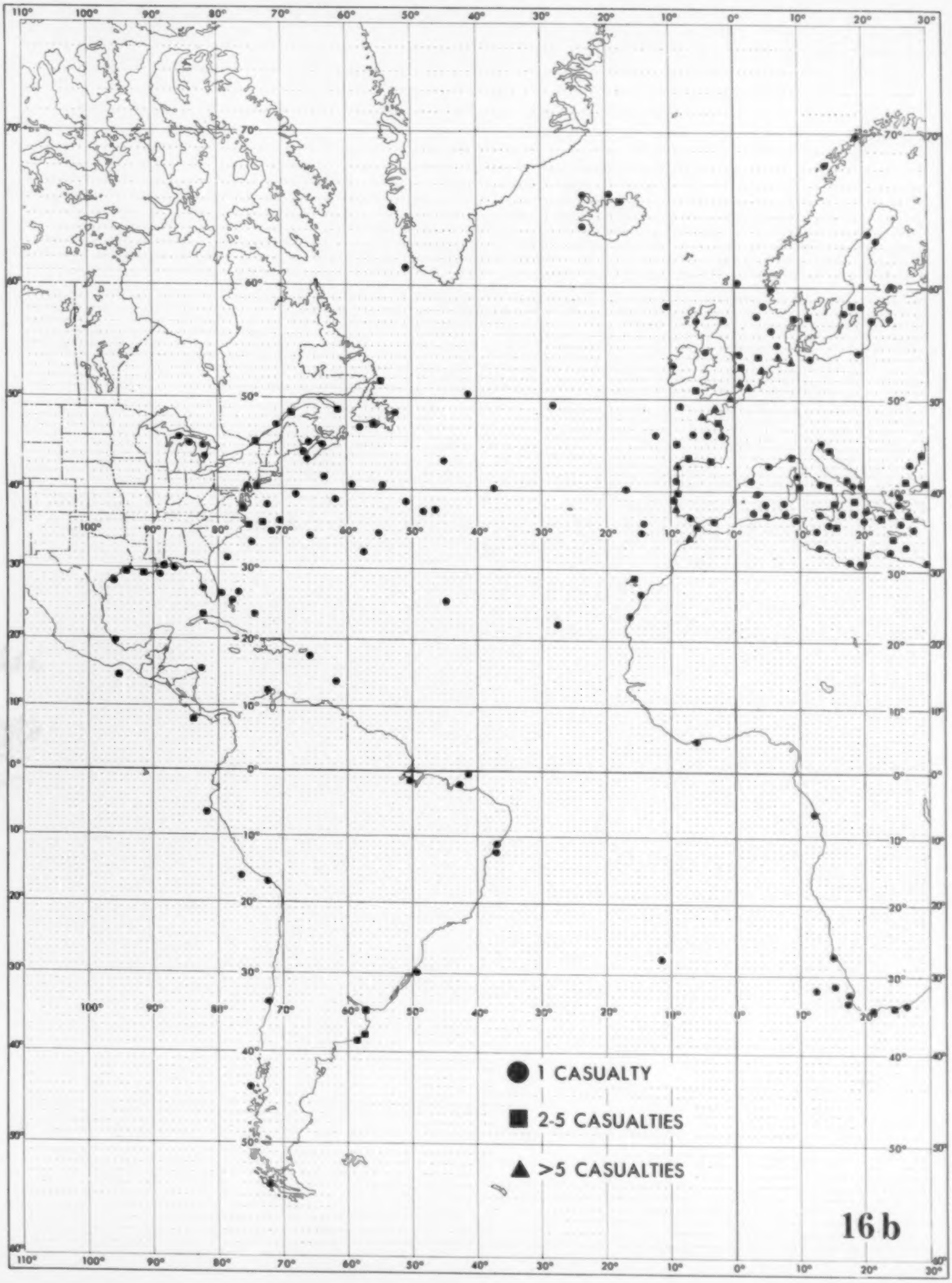
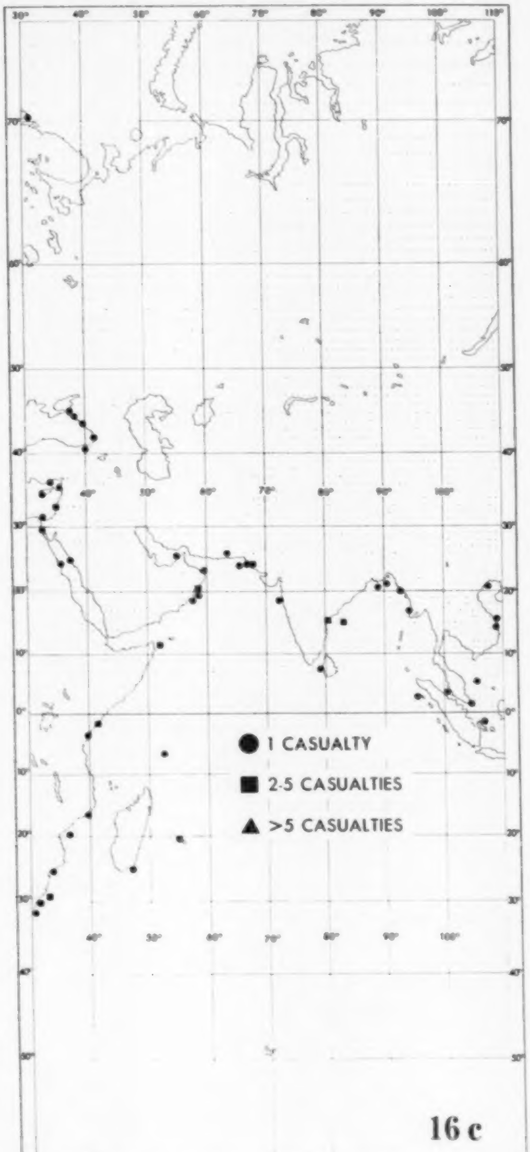


Figure 16a, b, and c.--A plot of 886 major weather-related maritime casualties for the period 1964-73 (Liverpool Underwriters' Association).


1 CASUALTY
2-5 CASUALTIES
>5 CASUALTIES
16 b



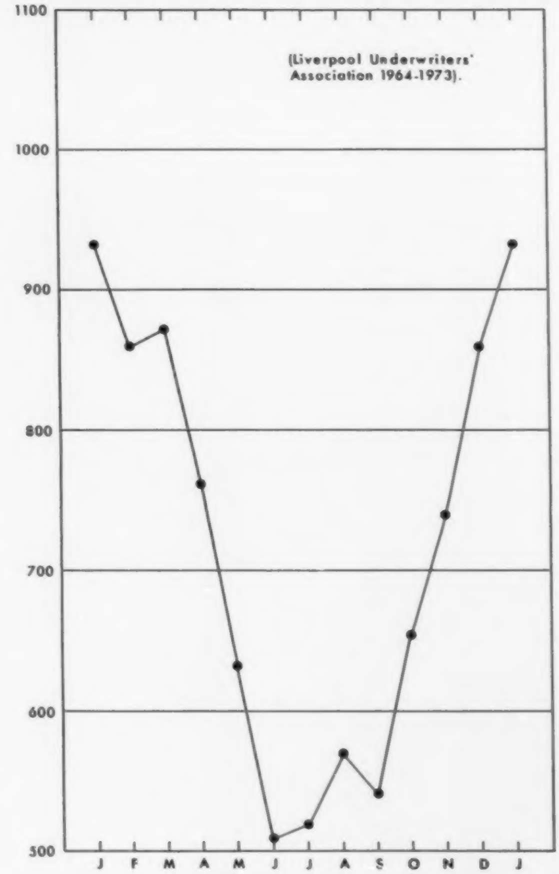


Figure 17.--Total significant weather-related casualties by month.

Figure 16 is a plot of 886 major weather-related casualties for the decade 1964-73 in map form. Because some areas were highly "accident prone," and points on the map would have run together, a casualty count convention of dots, squares, and triangles was used. A glance reveals that most weather casualties occur near coastlines or harbors. Some casualties that appear inland occurred in rivers or waterways.

The map also shows that most casualties occurred in the Northern Hemisphere or the Tropics. Thus, it was considered reasonable to ignore the Southern Hemisphere seasons and summarize all significant weather-related casualties for 1964-73 by month in figure 17. Many more casualties are included here than on the map, the subjective distinction being between "major" (for the map) and "significant" (for the graph). A pronounced seasonal trend is observed, with minor interruptions in March and August. The March hump is probably caused by a combination of the extreme variability and potential explosive nature of the weather, some increased activity, and the general feeling that the worst is past. This feeling of relief may result in a return to some northern great-circle routes that were spurned in midwinter. The August hump is no doubt due to increased fogginess that month.

Figure 18 shows total significant casualties (from all causes) for the 10-yr period 1964-73 as well as for a longer period, 1960-73. While not as extreme as figure 17, the seasonal trend is unmistakable and much more pronounced than the relatively small totals of figure 17 would seem to indicate. The conclusion is that while not directly caused by weather, a great many casualties are aggravated by weather conditions.

Despite all this, the weather relationship to casualties, in absolute terms, appears fairly steady through-

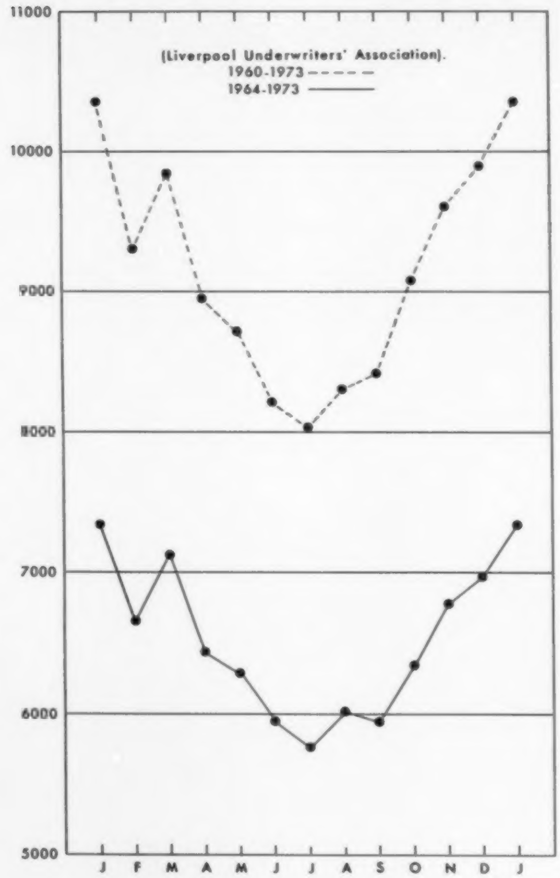


Figure 18.--Total significant casualties from all causes by month.

out the year. The highest proportion of casualties listing weather as the major cause is 12.9 percent in February. The lowest is 8.6 percent in June.

Tables 12 through 16 briefly summarize some basic information concerning the 886 major weather-related casualties (1964-73) depicted in figure 16. The totals in tables 12 and 13 do not equal 886 or 100 percent because of mention of more than one type of casualty and/or weather in some individual reports.

It is significant to note from table 12 that of the 886 major casualties, the third most common outcome was sinking (fig. 15), after hull damage and grounding (fig. 19). Since these statistics are mostly from larger, oceangoing ships, it is not surprising that heavy weather is the most often cited cause of casualty (table 7).

The losses in table 14 must represent staggering sums of capital, but they are not nearly so frightening as the morbid statistics given in table 15. Comparison with table 10 indicates that a great many injuries were not reported in the casualty returns. Frequently, we had to resort to subjective estimates of the number of dead. This was generally done when the only infor-

Table 12.--886 major weather-related casualties by type (Liverpool Underwriters' Association, 1964-73)

Type of casualty	Times cited	Percent of 886
Stranded	19	2.1
Aground	337	38.0
Damaged at dock	17	1.9
Dragged anchor	41	4.6
Hull damage	352	39.7
Machinery damage	97	11.0
Broke tow	25	2.8
Fire damage	25	2.8
Cargo lost or damaged	39	4.4
Leakage to sea	23	2.6
Broke up	66	7.4
Sank	290	32.7

Table 13.--886 major weather-related casualties by weather type (Liverpool Underwriters' Association, 1964-73)

Type of weather	Times cited	Percent of 886
Heavy seas	140	15.8
Heavy weather	386	43.6
Wind	62	7.0
Tropical cyclone*	107	12.1
Fog	232	26.2

*Hurricanes, typhoons, tropical storms

Table 14.--Number of 886 major weather-related casualties by degree of loss (Liverpool Underwriters' Association, 1964-73)

Degree of loss	Times cited	Percent of 886
Partial loss	496	56.0
Total loss	375	42.3
Not cited	15	1.7

Table 15.--164 of the 886 major weather-related ship casualties listed personnel casualties as well. Some had combinations of missing, dead, injured (Liverpool Underwriters' Association, 1964-73)

Personnel casualty	Numbers reported	Times cited
Missing	1245	103
Dead	1188	111
Injured	3	2

Figure 19.--None of the crew survived the grounding and breaking up of the Liberian freighter SAN PATRICK on rugged Ulak Island in the Aleutians. U. S. Coast Guard Photo.

Table 16.--Location of 886 major weather-related casualties (Liverpool Underwriters' Association, 1964-73)

Locale	Times cited	Percent of 886
At sea	314	35.4
Near coast	393	44.4
In port	153	17.3
Not documented	26	2.9

mation given was "entire crew lost," for which we used size and type of vessel to estimate the usual complement and, hence, the number lost. We can only assume that the "missing" are never to be heard from again.

Table 16 fortifies the notion that near shore is the most common area for mishaps, and in port is generally the safest place to be.

We sincerely hope that this article causes no one any undue concern and that all mates flipping through these pages make it into Sailor's Snug Harbor. If you want to do a little more reading, try Heavy Weather Guide by Harding and Kotch, U. S. Naval Institute, 1965.

ACKNOWLEDGEMENT

Many people helped compile the data in this report. In no particular order, Ron Baldwin, John Snelling, Beulah Taylor, Bob Courtney, Dot Hawkins, Sarah Lackey, and probably a few others counted and tallied during spare moments as this "pet" project progressed.

REFERENCES

American Institute of Marine Underwriters, 1974, Personal Correspondence With Their Offices at 99 John St., N. Y., N. Y. 10038.

Liverpool Underwriters' Association, Casualty Returns, 1960-73.

U. S. Coast Guard, Proceedings of the Marine Safety Council, various issues, 1960-75.

Hints to the Observer

SHIP REPORTS NEAR COASTS

Many storms have their origin or greatly intensify just off the coasts of land masses. Weather reports from ships near coasts are important, and sometimes more important than reports of the weather farther at sea. It is vital to know of the existence and character of storms along the coasts, for forecasting how and when they might affect land areas, especially built-up coastal areas, including ports and coastal shipping. The increasing importance of the Continental Shelf adds emphasis to this need. Meteorological and oceanographic data are vital to the utilization of this area. The same data are also vital for search and rescue efforts.

Weather forecasting is extremely dependent on knowing the current weather. In general, the forecasts can be no better than the weather observations. Ship reports are one of our most important sources of information for vast areas where there are no other reliable and accurate sources for measuring the surface weather conditions.

Meteorological satellites are providing important information, with detail and data continually improving, but they cannot replace good measurements of pressure and pressure changes, air and sea temperatures, sea conditions, and pertinent remarks provided by ship reports. Buoys are being tested and appear to have great potential, but it will probably be many years before their coverage can compare with the number of ship reports available.

The placement of buoys is a good example of the importance of near shore observations, as the first are being moored near-shore, where storms historically form or intensify.

We urgently need your ship observations. To help us do a better job, we ask that weather reports be made and transmitted whenever possible without regard to proximity to land. The newly instituted voice frequencies make it easier than ever to submit your observations.

Tips to the Radio Officer

For handy reference, figure 20 is a chart of the World indicating the radiofacsimile stations with their radio frequencies and in some cases hours of operation. Consult the latest <u>Worldwide Marine Weather Broadcasts</u> for specific details and schedules.

Figure 20.--Worldwide radiofacsimile chart.

Hurricane Alley

Dick DeAngelis
Environmental Data Service, NOAA
Washington, D. C.

Eight tropical cyclones roamed the seas of the Southern Hemisphere and North Indian Ocean during the last two months of 1975. Three reached hurricane intensity. Activity was slightly above normal. The tracks, based on positions from the National Environmental Satellite Service, are shown in figure 21.

NORTH INDIAN OCEAN

Both storms in these waters formed in November, and neither went beyond tropical storm strength. Maximum winds reached 35 to 40 kn. The earlier storm did move ashore near Calcutta on the 11th and most likely caused flooding.

SOUTH INDIAN OCEAN

One storm developed in each month. Both followed a similar path, recurving on the east side of the Malagasy Republic. Barbara, the December storm, was a severe hurricane. She generated hurricane winds from the 8th until the 12th, when she made landfall over the northern tip of Madagascar (fig. 22). At her peak on the 11th, maximum winds were estimated at 110 kn. On the 9th, Ile Tromelin reported east-southeasterlies at 35 kn about 100 mi south of the storm. Audrey formed on the 17th of November. Her winds climbed to 50 kn by the 20th. However, they never got any higher before she moved ashore over the northeast coast of the Malagasy Republic on the 29th.

AUSTRALIA-SOUTH PACIFIC REGION

The Western Australian region laid claim to the first male hurricane--Ray. Charlotte and Joan also formed in November, while Kim developed the following month. Ray came to life southwest of the Sunda Strait, moved southwestward past Cocos Island, and then recurved southeastward. He reached full manhood on the 23d as his winds rose to hurricane strength. It was over quickly, however, as winds climbed to 70 kn and then dropped off rapidly. While Ray was making history, Charlotte was flowering briefly just south of the Solomon Islands. She was only a minimal tropical storm and barely made it to the New Hebrides before dissipating. Joan was the most vicious storm of the month. She paralleled the northwest coast of Australia during the first week in December after coming to life at the end of November

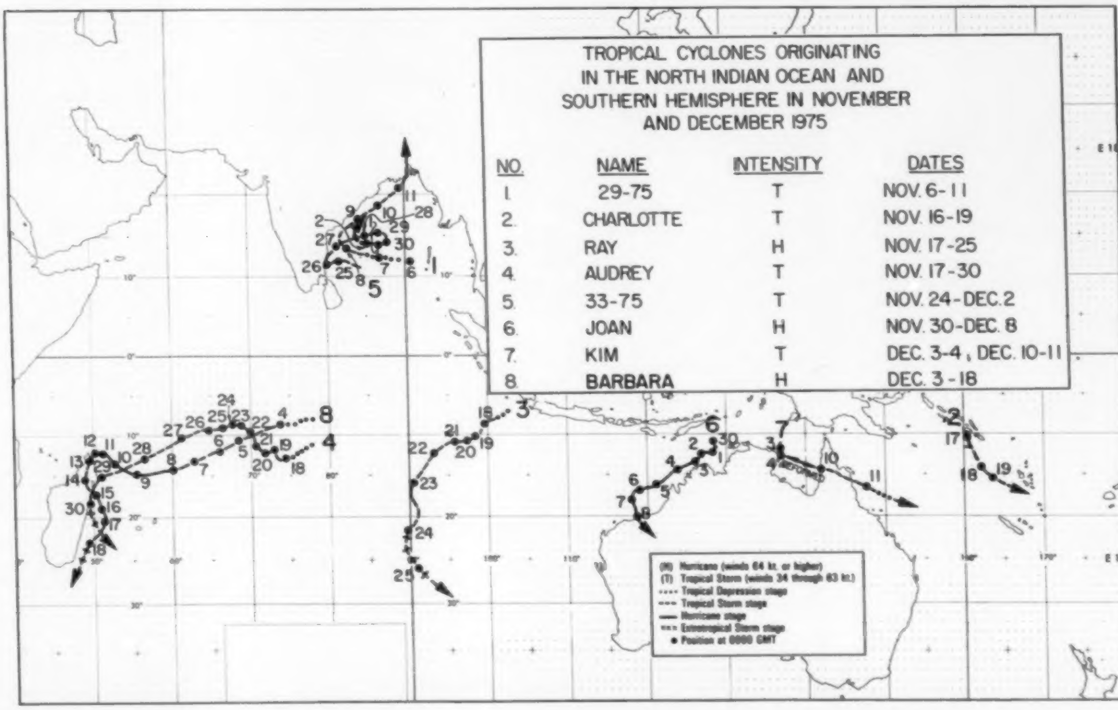


Figure 21.--Tropical cyclone tracks for November and December 1975.

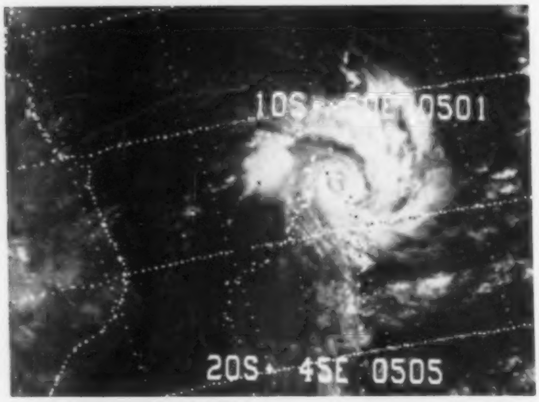


Figure 22. --Moving ashore near Anjiabe, Madagascar, early on the 12th, Barbara was still a potent hurricane.

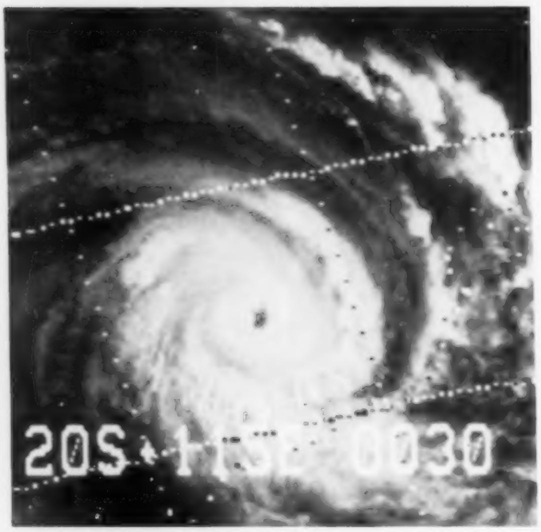


Figure 23. --Early on December 7, Joan's winds were estimated at 100 kn close to the center of her well-formed eye.

(fig. 23). Joan was a hurricane during that period. Winds were reported to have reached 135 kn as Joan crossed the coast near Port Headland on the 8th. Kim was a weak tropical storm which first developed on the 3d of December in the western Gulf of Carpentaria. She dissipated the following day, but she reformed nearly a week later on the other side of the Gulf. Winds reached 45 kn near her center as Kim moved across the Cape York Peninsula.

AUSTRALIAN TROPICAL CYCLONE NAMES

In the age of equality, Australia became the first country to use both male and female names for tropical cyclones. It is only fitting, since an Australian started the whole thing in the first place. Back in the 1890's, Clement L. Wragge, a pioneer meteorologist in Australia, began naming these storms after Polynesian beauties that he admired.[1] This was part of a larger scheme, which included naming extratropical systems after politicians that he did not care for.

The Australian area is divided into three tropical cyclone regions. Brisbane is the center responsible for eastern Australia and the seas north of 32°S, between 138°E and 160°E. Perth is responsible for western Australia and the waters south of 10°S, between 75°E and 129°E, and Darwin covers the Northern Territory and tropical waters from 129°E to 138°E. Each region has their own set of names. The following list contains the names for the 1975-76 season:

Eastern Region (Brisbane)	Northern Region (Darwin)	Western Region (Perth)
Alan	Joan	Ray
Beth	Kim	Sue
Colin	Linda	Terry
Dawn	Max	Vanessa
Eddie	Nita	Wally
Freda	Owen	Alice
Greg	Pearl	Bert
Hope		Carol
Ian		Dan
		Edna
		Felix

[1] E. Brewster Buxton, "Tropical Disturbance Eline--1898," Weatherwise, Vol. 23, No. 5, Oct. 1970.

U. S. NAVY PUBLICATIONS

The U. S. Navy is turning out a series of technical papers evaluating western North Pacific harbors as typhoon havens for ships. This important work is being done by the Naval Environmental Prediction Research Facility, Naval Air Systems Command, at Monterey, Calif. In order to classify a harbor as safe or unsafe during storm passages, a number of factors must be considered. These include the characteristics of the harbor, the facilities available, wind and wave action, bottom holding quality, port congestion, and problems that may be encountered during storm conditions. Historical western Pacific tropical cyclone tracks were analyzed to determine the threat to various harbors. Firsthand observations by the authors and conversations with local harbor authorities and meteorologists are incorporated into the conclusions.

The following is a list of the reports presently available through the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Va. 22161:

NAVENVPREDRSCHFAC Technical Paper No.	Title
9-73	An Evaluation of Hong Kong Harbor as a Typhoon Haven.

6-74 An Evaluation of the Harbors of Kaohsiung and Chilung (Keelung), Taiwan as Typhoon Havens.

13-75 An Evaluation of the Harbors of Subic Bay and Manila, Republic of the Philippines, as Typhoon Havens.

15-75 An Evaluation of the Harbor of Yokosuka, Japan as a Typhoon Haven.

17-75 An Evaluation of the Harbor of Sasebo, Japan as a Typhoon Haven.

19-75 An Evaluation of Apra Harbor, Guam as a Typhoon Haven.

21-75 An Evaluation of the Harbors of Buckner Bay and Naha, Okinawa as Typhoon Havens.

22-75 An Evaluation of the Harbors of Inchon, Pusan, and Chin Hae, Republic of Korea as Typhoon Havens.

23-75 An Evaluation of the Harbors of Iwakuni and Kure, Japan as Typhoon Havens.

24-75 An Evaluation of the Numazu Operating Area and Kagoshima Harbor as Typhoon Havens.

On the Editor's Desk

ANCO TEMPLER RESCUE

At about 0400 on the morning of November 14, an explosion and fire rocked the South Korean fishing vessel KWANG MYUNG. Two of the 36 crewmen were killed in the blast, and 2 others were seriously burned. At the time of the accident, the ship was more than 300 mi off the Oregon coast.

A C-130 long-range rescue aircraft from Air Station San Francisco was dispatched. It located the burning ship about 0600 that morning. The nearest Coast Guard cutter was at least 30 hr away, but even so, the CAMPBELL from Port Angeles and the MODOC from Coos Bay got underway.

Although the on-scene aircraft was able to pinpoint the location of the burning ship, it was unable to provide much assistance. The aircraft commander reported that most of the crew were huddled at the forward end of the ship away from the fire. There were heavy seas and strong winds at the time. A storm was developing, and the weather would worsen as the day progressed.

The ship was out of range for the long-range rescue helicopters at Air Station Astoria, and the developing storm between the land and the burning ship made it impossible to use Air Force long-range, in-flight refuelable helicopters.

The question facing the Coast Guard was how to get immediate help to the crew of the burning ship.

The answer was AMVER--a Coast Guard-operated system which makes almost every ship afloat a potential rescue ship. AMVER stands for Automated Mutual-Assistance Vessel Rescue System.

Merchant ships of all nations are encouraged to send sailing reports and periodic position reports to the AMVER Center at Coast Guard Base, Governors Island, N. Y. That information is entered into a computer which generates and stores the positions of the vessels, in addition to other information about the ships which could be valuable for determining their search and rescue capability.

Upon request, the information stored in the system is made available to any search and rescue center in

Figure 24.--The British tanker ANCO TEMPLER that rescued the crew of the KWANG MYUNG.

the world.

Almost within minutes after identification of the burning KWANG MYUNG's position, the AMVER system reported the location of four ships close enough to be of possible assistance.

The nearest was the 556-ft British tanker ANCO TEMPLER (fig. 24), bound from the United States to Japan. Upon notification of the emergency, the ANCO TEMPLER's captain, Keith Richmond, immediately turned his ship toward the scene. By 0900 that morning, the ANCO TEMPLER had the KWANG MYUNG in sight.

Rescue operations would not be easy as weather conditions continued to deteriorate. The seas were cresting at 15 ft, and 30-kn winds buffeted the area. These weather conditions were coupled with the fact that the ANCO TEMPLER was fully loaded with a dangerous cargo of petrochemicals and lubricating oil. If the rescue tanker did not stay well away from the burning fishing vessel, the tanker could catch fire.

The storm continued to grow as the ANCO TEMPLER maneuvered to assist. The desperate Korean fishermen launched two rafts from the burning ship. The rescue ship fired a line to the rafts. By hand, both crews pulled together to bring the liferafts 400 yd across churning seas to the safety of the tanker.

As the crew of the ANCO TEMPLER was pulling the Korean fishermen aboard, the seas were breaking over the TEMPLER's other side. Thirty minutes later, the winds had increased to hurricane speed. "Had we waited, we would not have been able to get them aboard," the ANCO TEMPLER's captain said.

A variety of contingency plans had been developed at the Coast Guard Rescue Center to remove the fishermen from the British ship once they had been safely picked up, but the ferocity of the seas was so great that the two cutters dispatched were forced to return to port.

The CAMPBELL had been beset by mechanical troubles, and the MODOC had taken some 45-degree rolls which inflicted structural damage and minor injuries to several crewmen. The Rescue Controller in Seattle ordered the ships to return as the storm ruled out any possibility of an at-sea transfer.

The ANCO TEMPLER had left Portland the day before, bound for Japan, but now they had two men aboard who needed medical assistance as soon as possible, so the ship set course for Seattle.

Fortunately for the burned men, the wife of one of the ANCO TEMPLER's crewmen was aboard, and she was a trained nurse. For almost 48 hr, with no sleep and little rest, she cared for the injured men.

When the ship arrived in Port Angeles, Wash., on the afternoon of the 15th, a maritime physician boarded the tanker. The burned fishermen were immediately flown to Harborview Hospital in Seattle by a helicopter from Coast Guard Air Station Port Angeles. After the medical evacuation of the injured fishermen, the ANCO TEMPLER continued to Seattle where the rest of the KWANG MYUNG's crew was disembarked.

The Coast Guard's AMVER system worked; lives had been saved. Man's concern for his fellow man still exists.

NOAA SATELLITE INDICATES WINTER CLIMATE NOT WORSENING

Satellite monitoring of snow cover over the Northern Hemisphere for the past 9 yr has led NOAA scientists to question predictions that North America's climate is trending toward harsher winters.

Since 1966, camera- and radiometer-equipped NOAA satellites have been providing images from which hemisphere snow cover can be estimated on a weekly basis. Weekly snow and ice charts, developed from imagery, form an almost unbroken set of winter snow and ice data for the last 9 yr, lacking only 2 mo of the 1966-67 winter. They represent the most complete record of hemisphere snow cover available. An analysis of the charts shows no significant change in North American snow cover during the entire period. Eurasian snow cover showed some fluctuation which peaked in the winters of 1971-72.

Snow cover is an important, sensitive variable which influences climatic change, and the lack of systematic increase in the Northern Hemisphere snow cover tends to contradict evidence presented by some proponents of climatic change that the current climate is changing adversely with attendant cool hemisphere temperatures and harsh winters.

Some scientists have predicted that, for a variety of reasons, winter weather in the Northern Hemisphere is becoming more harsh and could result in a southern movement of the edge of the polar ice cap. Such a phenomenon, they claim, could come about with only a few degrees drop in the average winter temperature.

The NOAA researchers recognize that snow cover is but one of many variables that influences, and in turn is influenced by, the climate. However, the fact that no significant deteriorating trend is discernible should perhaps be encouraging.

The satellite observations came from polar-orbiting satellites. Data included measurements of snow cover for both North America and Eurasia for the months of December, January, February, and March, with close correspondence of the Northern Hemisphere data to that for Eurasia.

JAPANESE METEOROLOGICAL BUOY LOST

The Japanese meteorological buoy No. 5 which was operating at 37°N, 140°E, has been lost since the last of December 1975. Any ship that might have information on the fate of the buoy or sights the buoy drifting, please contact the Japan Meteorological Agency in Tokyo, Japan.

WELLAND CANAL ENDS 75 SEASON

The Welland Canal, the shipping link between Lake Ontario and Lake Erie, closed the 1975 navigation season at noon on December 30. Traffic no longer was accepted for transit through Lock Number 1 at the Lake Ontario end or Lock Number 8 at the Lake Erie end.

The Montreal-Lake Ontario, or so-called international, section of the seaway ended the 1975 shipping season on December 18. All ocean-going vessels scheduled to leave the Seaway-Great Lakes system did so by that date.

Estimated figures compiled through December 21 indicate that 58,615,000 tons of traffic, or about 14.2 percent more than in 1974, have passed through the Welland. Traffic estimates as of December 21 for the Montreal-Lake Ontario section totaled 47,900,000 tons, approximately 8.5 percent greater than 1974.

Figure 25.--The newest and most modern U. S. Coast Guard Icebreaker, the POLAR STAR.

COAST GUARD LISTS 1975 ACHIEVEMENTS

The Coast Guard wound up 1975 with probably more "firsts" than in its previous 185-yr history. The service claimed:

Maintenance of open shipping lanes for the entire year in the Great Lakes.

Receipt of its first two applications for offshore, deepwater port installations.

Perfection of a tracking technique to enable it to trace oil spills and its use in tracking one offender from the incident in Florida all the way north to Philadelphia.

The service's 37,000 active duty personnel with 250 ships, 160 aircraft, and 2,000 small craft, also moved into environmental protection in a big way, forming three emergency strike teams to cope with spills here and abroad and perfecting an airborne surveillance system.

To protect another aspect of the environment--fisheries--the Coast Guard seized 15 foreign fishing vessels which were found operating illegally and extracted some $3.8 million in fines, plus two vessels which the owners decided not to redeem.

The Coast Guard took delivery on January 17, 1976, of the first new icebreaker--POLAR STAR (fig. 25)--the service has acquired in years. A sister-ship, POLAR SEA, is still under construction.

Thanks to the opening of the new control system on the Houston-Galveston, Tex., ship channel during 1975, 70,000 transits were made in that busy area during its first 6 mo.

And, Coast Guard began admitting women to its officer training academy at New London, Conn.

OIL POLLUTERS TRACED BY FINGERPRINTING

Ships spilling oil in U. S. waters may be leaving "fingerprints in the ocean" which could lead to heavy fines and even imprisonment for those responsible, since the U. S. Coast Guard began implementing its oil spill fingerprinting technique.

In the past, polluters have been free to continue their dumping unless they were caught in the act by spotting operations like the airborne oil surveillance system being developed by the Coast Guard. But those days have been over since the first major use of the technique began last summer.

For more than 3 mo, Coast Guard investigators pored over the logs of 247 vessels, taking oil samples

from the bilges and tanks, and gathered additional samples from the shoreline in the Florida Keys to track down the vessel responsible for a massive oil slick which clogged the area.

Laboratory technicians of the Coast Guard and the Environmental Protection Agency then began to attempt to match the samples.

These samples were bombarded with ultraviolet infrared light and then flash vaporized to bring out identifiable traits which appear as complex curves on paper. Each oil mixture contains different amounts and kinds of hydrocarbon molecules, and each will produce a different fingerprint.

In order to bring out the distinct trait of an oil sample, the Coast Guard uses four different analyses. Each can produce a good rate of accuracy when used alone, but a nearly perfect rate of accuracy can be produced when all four are implemented.

The results of the oil spill fingerprinting technique led to what is believed to be conclusive proof of which ship was responsible for the massive oil spill off the Florida Keys. Under U. S. antipollution law, the ship's captain faces a fine of $10,000 and possible imprisonment for a year for failure to report the oil discharge--whether it was accidental or intentional.

A $5,000 penalty, assessed against the ship's owners, plus payment of cleanup costs along the Keys which could amount to $367,430, are pending a court decision.

In another recent case, samples were supplied from a spill which occurred on the Connecticut River near Hartford. The identification labels on these samples indicated that they were from different sources. Subsequent analyses by the oil spill fingerprinting technique provided the surprising result that not one, but two of the three sources were responsible for the spill. However, further investigation revealed that the two implicated sources actually came from the same facility which was operating under two different corporate titles.

During the past few years, spills from tankers disposing of ballast water have become one of the primary sources for oil pollution--with some studies indicating such routine operations have caused from 66 to 96 percent of a given year's oil pollution.

The Coast Guard believes the oil spill fingerprinting technique has the potential to be a major deterrent against such arbitrary dumping.

NOAA HURRICANE HUNTER RETIRING AFTER 16 YEARS

Thirty-Nine Charlie, a famous, tired old airplane, has retired. Charlie was NOAA's most venerable hurricane hunter. The DC-6 has chased the greatest storms on Earth since 1959 (fig. 26).

In its 16 yr of flying, Charlie made 321 penetrations of 42 hurricanes. Its fuselage bears the flags of 40 nations and one territory. Probably no other aircraft in the world has done so much as an airborne research platform to advance human safety from the elements or to further scientific understanding of the atmosphere and oceans.

During its long and spectacular career, the plane flew some of the world's most difficult and dangerous atmospheric terrain--from monsoons over the Indian Ocean to hurricanes in the tropical Atlantic, and into

Figure 26.--The venerable THIRTY-NINE CHARLIE when she was queen of the fleet.

the fury of towering cumulus clouds in Florida and hail-making clouds in the midwest. It has flown more than 5,600hr and more than a million miles.

In 1966, during Hurricane Inez, Charlie flew through winds approaching 200 mi/hr; in 1975, during Hurricane Gladys, electrical failure brought the loss of most instrumentation, but despite extreme turbulence the crew located the eye of the storm.

In research flights involving less spectacular meteorological displays, the plane's crew frequently was assigned to fly missions at levels as low as 50 ft. During one experiment, Charlie's track was so low over the ocean that a research ship observed the airplane left a wake. At the time, the plane bore a gold stripe, and after that flight it was briefly dubbed "the yellow submarine."

Based at Miami International Airport, the plane was the oldest member of NOAA's airborne research fleet: a C-130; a WP-3D being readied for 1976 operation; and a second WP-3D scheduled for delivery early in the year.

GREAT LAKES/ST. LAWRENCE SEAWAY 1976 NAVIGATION SEASON OPENING DATES

The Seaway system is scheduled to open at 1300 hours on the following dates:

Area	Opening date
Montreal-Lake Ontario	April 1, 1976
Welland Canal	April 1, 1976
Sault Ste. Marie (Canadian)	April 5, 1976

These dates are subject to weather, ice conditions, and vessel traffic demand. The Seaway entities will continue to evaluate these factors and advise users of any changes in the opening dates.

In the Montreal-Lake Ontario section, only daylight navigation will be permitted from the opening date until floating aids sufficient to permit night navigation have been installed.

U. S. SEAWAY LOCKS TO BEGIN ICE FLUSHING PROJECT THIS WINTER

The first phase in the installation of so-called flushing port systems for the two U. S. -operated locks on the Montreal-Lake Ontario section of the St. Lawrence Seaway is to begin this winter. The project is aimed at aiding early-season navigation by helping clear ice from the lock chambers safely and quickly. Ice floes get into the chambers as a result of winter ice movement and through the effects of early-season vessel transits.

The overall project is scheduled for completion in the winter of 1978-79. The upriver Eisenhower Lock is to be worked on during the current and following winter, while work on the Snell Lock will be done during the subsequent two off-seasons.

The two project phases at each lock are the installation of discharge ports at the upstream end of the lock chamber, which is done in the first winter, and work done within the lock wall, which is undertaken in the second winter. The project entails installation of new equipment, as well as a concrete construction program.

The flushing system to be used at Eisenhower and Snell was designed and will be installed by Development Corporation. With the exception of a similar system now in operation at two of the five Canadian-operated Seaway locks, nothing else like the flushing port system is in use in the world.

A fiberglass manifold pipe measuring 10 ft in diameter will be installed, through which water introduced at the upstream end will flow. The manifold will feed five 4-ft-wide discharge ports, which, in turn, will direct the water downstream. The manifold and the discharge ports will be situated directly beneath the concrete sill protection bumper at the upstream end of the lock.

Phase II calls for installation within the lock wall of an intake conduit and control valve which will channel the water to the 10-ft-wide manifold pipe.

The new system will be operational at the Eisenhower Lock at the start of the 1977 shipping year, and during the following off-season the same two-phase procedure will begin at Snell Lock.

CELESTIAL "TRIPLE PLAY" INVOLVING OZONE SHIELD COULD HAVE EXTINGUISHED ANCIENT SPECIES

The biological consequences of a weakened stratospheric ozone shield may be legible in the fossil records of events occurring hundreds of thousands of years ago. About 700,000 yr ago, the Earth's magnetic field almost disappeared as it decayed toward a reversal of polarity, a phenomenon which appears to happen every few hundred-thousand years. A millennium or two later, the reversed magnetic field regained its normal strength. During this magnetic nap, some marine life forms seem to have disappeared.

Scientists have now advanced a plausible mechanism for this puzzling "faunal extinction" during geomagnetic polarity reversals. It is a celestial triple play, in which the weak magnetic field, large solar flares, and chemical reactions in the high atmosphere combine to destroy the stratospheric ozone layer, admitting the Sun's hard ultraviolet radiation into our garden of life.

It appears that current concern about possible anthropogenic destruction of stratospheric ozone may be well founded, since it is possible that major ozone depletions occurring in the distant past have had a profound effect on the development of life as we know it.

Timing of the last magnetic polarity reversal is based on ancient magnetic fields "frozen" in sedimentary deposits beneath the ocean floor and recovered by scientific deep-drilling operations. The same deep ocean cores which provide this record of ancient magnetism also offer evidence that some species of marine micro-organisms disappeared during the magnetic reversal. Some scientists believe that evolutionary "quantum jumps" through mutation may also have accompanied past reversals of the geomagnetic field, when the disappearance of some species provided a biological vacuum which mutant species quickly filled.

Attempts to explain this apparent connection have included increased cosmic radiation reaching the Earth's surface, climatic changes caused by a reversed magnetic field, and even some biomagnetic effect in the organisms themselves. While all are still the subjects of study, none quite accommodates the physical evidence.

The scenario proposed by the scientists is compelling. It begins with the Earth's magnetic field declining toward its polarity reversal. Normally, the geomagnetic field lines would deflect incoming energetic particles toward the Earth's magnetic poles, but near the time of the polarity reversal, our geomagnetic guard is down.

Then a large solar flare (fig. 27), comparable to that of August 1972 or larger, occurring during the thousand-year interval of the reversal would shower the Earth with solar protons carrying energies ranging from 10,000 to a billion electron-volts. Without a strong magnetic field to deflect them poleward, the particles would bombard virtually the entire planet. Still, the Earth's second line of defense--the stratospheric layer of ozone that blocks the Sun's biologically damaging ultraviolet radiation--would be intact.

Recent work has demonstrated that energetic solar particles and cosmic radiation (particles from outside our solar system) set off chemical reactions in the high stratosphere that produce large quantities of nitric oxide (NO), a voracious chemical enemy of ozone. A few large solar flares each year are estimated to produce as much nitric oxide as the total annual production from the largest known natural source--oxidation of nitrous oxide (N_2O), or laughing gas, which is produced naturally by bacterial action at the Earth's surface and migrates slowly upward into the stratosphere.

Once nitric oxide is introduced into the stratosphere, it becomes part of an extremely efficient ozone-destroying cycle, in which virtually no nitric oxide is lost. Thus, in the unmixed, layered world of the stratosphere, the nitric oxide can remain for years, catalyzing the destruction of ozone and reforming until natural processes finally remove it in the form of rained-out nitric acid.

Normally, the geomagnetic field would restrict this nitric oxide production to high geomagnetic latitudes; but with the field nearly gone, this production would occur over much of the globe. Scientists calculate that solar flares comparable to those of August 1972,

Figure 27.--Compare the size of this large solar flare with the 12,760 km diameter of the earth.

occurring during geomagnetic reversal, would produce enough nitric oxide to reduce stratospheric ozone by nearly 10 percent, and flares 100 times that large would cause almost a 50 percent reduction in the ozone layer.

Thus weakened, the ozone shield would admit the strong ultraviolet rays of the Sun. It is estimated that under such conditions, a proton event comparable to that of August 1972 would increase the effective ground-level ultraviolet dosage by 15 percent. Flares 100 times as intense would increase the dosage by 160 percent.

Biological species that had evolved over the preceding several million years of geomagnetic stability might be unable to survive the harsher ultraviolet environment and would presumably be replaced by other species with more adaptability. Such increases would inevitably have some effect on simple aquatic microorganisms, many of which presently seem to be living close to their maximum tolerance of ultraviolet radiation. Aside from possible direct effects on higher forms of life, indirect damage is likely to result from the consequent upset of the ecological cycle.

The theory advanced will find more application in estimating present-day biological effects of an eroded ozone shield than with the next reversal. Scientists estimate that, at its present rate of decay, the geomagnetic field will next reverse itself between the 40th and 50th centuries. Then for a geological twinkling of an eye, the Earth's magnetic field will almost disappear--perhaps taking some life forms with it.

CASUALTIES ABOARD U.S. COMMERCIAL VESSELS

A total of 5,551 ships were involved in 3,305 casualties during the year ending June 30, 1975, according to a tabulation contained in a recent issue of the Proceedings of the Marine Safety Council. Storms or adverse weather were the primary cause of 293 of the 5,551 individual casualties, and unusual currents were the primary cause of 12 of these casualties. There were 190 deaths and 74 injuries as a result of 131 ship casualties; one of these casualties was the result of collisions in fog, resulting in one injury. Capsizings, founderings, and floodings constitute the category resulting in the highest number of casualties, 45, with 79 deaths and 3 injuries. Of the 131 casualties causing deaths and injuries, storms or adverse weather were the prime cause of 21 deaths.

In addition to the above deaths and injuries, there were 348 deaths and 1,216 injuries aboard ships not involved in ship casualties. Natural causes accounted for 144 of these deaths; 113 persons fell overboard and drowned, and only 9 deaths were primarily attributed to weather conditions (8 fell overboard). Seventy-six of the injuries were a direct result of weather.

Casualties involving commercial vessels are required to be reported to the U.S. Coast Guard whenever the casualty results in 1) actual physical damage to property in excess of $1,500, 2) material damage affecting the seaworthiness or efficiency of a vessel, 3) stranding or grounding, 4) loss of life, and 5) injury causing any person to remain incapacitated for a period in excess of 72 hr, except injury to harbor workers not resulting in death and not resulting from vessel casualty or vessel equipment casualty.

MARINE WEATHER REVIEW

The SMOOTH LOG (complete with cyclone tracks[figs. 30-33], climatological data from U.S. Ocean Station and Buoys[tables 17 and 18], and gale and wave tables 20 and 21), is a definitive report on average monthly weather systems, the primary storms which affected marine areas, and late-reported ship casualties for 2 mo. The ROUGH LOG is a preliminary account of the weather for 2 more recent months, prepared as soon as the necessary meteorological analyses and other data become available. For both the SMOOTH and ROUGH LOGS, storms are discussed during the month in which they first developed. Unless stated otherwise, all winds are sustained winds and not wind gusts.

Smooth Log, North Atlantic Weather

September and October 1975

SMOOTH LOG, SEPTEMBER 1975--The storm track pattern was near normal this month, although, in general, they were depressed about 5° latitude south of their climatological average. The main track that affected shipping came across the Great Lakes to northern Newfoundland and then toward Iceland. Another track was from the north central ocean (45°N, 30°W) to Scotland and Norway. From a quick glance, it appears that more of these occurred during the last half of the month than the first half. The storms that affected the Labrador Sea and Baffin Bay area seemed to prefer the first part of the month.

As usual, the largest feature on the mean sea-level pressure chart was the Azores High at 1026 mb, centered near 37°N, 33°W. This was 5 mb higher than normal. The main Icelandic Low center was 995 mb over the Greenland Sea, many miles from its normal 1005-mb center near 61°N, 30°W. A 1002-mb LOW was centered near that position.

The main area of the North Atlantic of interest to shipping (25° to 60°N) was ruled by positive anomalies. The center of the major positive anomaly was 6 mb, near 40°N, 30°W. The primary negative anomaly was 13 mb, south of Spitsbergen. There was also a 4-mb negative anomaly near 15°N, 35°W.

The main upper-air flow was zonal, with troughing over the Great Lakes and the coast of Europe. The height of the 700-mb surface was higher across the 30°N latitude belt and lower over the Arctic. The primary LOW was normally located over northern Ellesmere Island, but an abnormal LOW reflected the surface LOW over the Greenland Sea. Most of the ocean between 25° and 60°N, except over the European coast, reflected positive anomalies.

September's storms--Eloise, Faye, and Gladys--were all hurricanes. They kept the North Atlantic area active from midmonth on. Only Eloise reached the United States. Faye stayed well out in the Atlantic, while Gladys threatened the East Coast before recurving. They are described in the annual article, "North Atlantic Tropical Cyclones, 1975," on page 63 of this issue.

Extratropical Cyclones--The track of this LOW can be traced from the central North Pacific and across Alaska and Canada. At times, it became very weak, but a center could always be found. It moved across Labrador and into the sea on the 16th. The LOW raced across the Labrador Sea to join and reenforce an old LOW south of the Denmark Strait, late on the 17th. The LOW remained quasistationary and deepened. At 1200 on the 19th, the pressure was 985 mb. The SNORRI STURLUSON was at 64.5°N, 35°W, and battling 50-kn winds. Two other fishing vessels in the vicinity reported 45-kn winds.

On the 20th, the LOW started moving eastward in the wake of a northward-moving storm, which quickly absorbed it on the 21st.

A front had pushed south to about 30°N. As the HIGH behind the front moved seaward, a wave formed on the front just off the coast, and, by the 17th, a closed circulation had formed around the apex off Cape Hatteras. It moved eastward, deepening slowly. At 1200 on the 19th, the 996-mb center was near 40°N, 50°W. The ATLANTIC FOREST was in the southwestern quadrant (38°N, 53°W), sailing east-northeastward with 45-kn winds and 20-ft waves. South of the center, the HOHKOKUSAN MARU, MINERAL OUGREE, and PROPONTIS contended with lesser gales. Twelve hours later, gales were being reported all around the center, with the CETRA COLUMBA contributing 40 kn.

At 1200 on the 20th, the PROPONTIS was being pushed by 50-kn winds. The AMERICAN ALLIANCE (43°N, 45°W) was in the northwestern quadrant, with 45-kn gales. On the 21st, the LOW turned northward to a northeasterly track. It was now invading the circulation of an Arctic LOW moving along 60°N. The GREAT REPUBLIC, at 42.6°N, 31.8°W, had southerly 45-kn winds. The stronger northern LOW

rapidly absorbed the circulation of this LOW, but it managed to retain its identity as a frontal wave until the 24th, over Norway.

A LOW sprang from Hudson Bay on the 19th. It moved due east along the 60th parallel. The SEDCO 445, north of Hopedale, reported 40-kn winds, at 1200 on the 20th, when the 996-mb center was at 60°N, 55°W. As the LOW center passed over Kap Farvel, the weather station there reported heavy snow.

At 0000 on the 22d, the pressure had decreased to 980 mb at 61°N, 31°W, and the SVENDBORG radioed 45-kn winds near 60.5°N, 33°W. The ANNA JOHANNE, at 59.6°N, 40.4°W, had only 35-kn winds, but the seas were raging at 23 ft. Twelve hours later, the SVENDBORG suffered 50-kn winds. A frontal system from a peripheral LOW to the east was bringing 40-kn gales to the Shetland Islands and the North Sea.

On the 23d, the center was south of Iceland, and the LETCHWORTH, east of the Outer Hebrides, was headed into 50-kn westerlies driving 26-ft waves. The seas south of the center were reported as 25 to 28 ft by several ships, including OWS LIMA. On the 24th, the LOW raced to join another LOW over Norway, as a third LOW approached from the west.

This storm was generated over the Gulf of St. Lawrence, near the triple point of an occlusion, on the 22d. By the time the storm was 24 hr old, it was developing 50-kn winds, as reported by the DAGHESTAN near 52.5°N, 49.5°W. The LOW was near 53°N, 47°W, at 994 mb. The HANNOVER was near 49°N, 42°W, with 40-kn gales. Twelve hours later, at 0000 on the 24th, she was near 50°N, 38°W, and being buffeted by 60-kn winds on her stern. The LOW was racing eastward at over 50 kn, with ships suffering momentary high winds as the LOW passed north of their track. At 0000 on the 25th, the 978-mb LOW was over northern Scotland. The west coasts of the British Isles suffered gale-force winds. At that time, the track turned northeastward to parallel the coast of Norway.

The LOW was still deepening and, at 1200 on the 27th, was 965 mb off Lofoten, Norway. OWS MIKE was tossed by 50-kn winds and 25-ft seas. Winds of 35 to 45 kn were common along that coast. On the 28th, Spitsbergen had 45-kn gales from the northeast. The center of the LOW then moved into the vicinity of the island, where it remained until the 31st.

Early on the 25th, there was a col area in the circulation south of Greenland and east of Newfoundland. By 1800, a LOW had developed, and, at 0000 on the 26th, it was 993 mb, with a well-developed circulation. The 1200 chart showed the LOW at 47.5°N, 20°W, with gales in all quadrants. The DART AMERICA fought 40-kn winds and 16-ft waves, 400 mi west of the center. Farther west, another British vessel had 40-kn winds and 25-ft waves pounding her port side. Just prior to frontal passage, OWS ROMEO also measured 40 kn. American ships in the area that day were the AMERICAN RANGER, GEORGE WALTON, and the LIGHTNING, all reporting 45 kn. The AMERICAN TRADER, southwest of the center at 43.1°N, 27.4°W, fought 50-kn winds and 13-ft swells.

On the 27th, the LOW was moving northeastward over Ireland, and Lands End had 40-kn winds. The EXPORT PATRIOT reported 42-kn winds and 20-ft swells at 46.7°N, 18.1°W, and the FERNDALE, at 48.6°N, 09.8°W, fought 45-kn winds and 28-ft seas. The LOW continued that same track and was over Finland, on the 28th, and no longer a danger to shipping.

A large LOW tracked across northern Canada and the Davis Strait. Early on the 26th, it moved against the mountains and fjords of southwestern Greenland and reformed off the southeastern coast later that day. At 1200 on the 27th, the 986-mb center was near 56°N, 33°W. The ATLANTIC CAUSEWAY at 51.8°N, 37.2°W, found 45-kn winds and waves up to 20 ft. Ocean Weather Station Charlie also had 20-ft swells, but the winds were only 35 kn.

The storm was moving southeastward, and there were gale reports by several ships on the 28th. At 1800, the EXPORT PATRIOT (45.2°N, 25.9°W) was swamped by 20-ft seas and 36-ft swells driven by 45-kn winds. The MUSSON was near 50°N, 30°W, with 40-kn winds and 23-ft seas at 0000 on the 29th.

On the 30th, the storm was moving northward with a 980-mb center. Ocean Weather Station Lima contended with 45-kn gales and 23-ft seas. A new center developed to the south, and on October 1 another center over the North Sea replaced both.

A stationary front paralleled the U.S. east coast north to New Brunswick, where it turned east-southeastward on the 28th. Hurricane Faye was approaching Nova Scotia from the south. At that time, a closed circulation developed where the front bent eastward. As hurricane Faye turned eastward, this LOW developed and followed in her wake. At 1200 on the 29th, the IMPERIAL QUEBEC was swept by 45-kn winds off Cabot Strait, and the AXEL battered into 45-kn winds and 16-ft seas northeast of the center, which was about 100 mi east of St. John's.

The extratropical LOW was now far larger than Faye, which turned extratropical on the 29th. On the 30th, among others, the HASSELBURG found 45-kn gales and 20-ft seas near 41.5°N, 44°W, or about 400 mi southwest of the center. Two EXPORTS had their troubles on the 30th. The EXPORT AIDE had 55-kn winds, 25-ft seas, and 31-ft swells at 39.4°N, 27.5°W. The EXPORT PATRIOT had 45-kn winds and 33-ft swells at 44.1°N, 41.6°W.

On October 1 at 0600, the EXPORT AIDE (39.9°N, 31.4°W) wrestled with 55-kn winds, 30-ft seas, and 39-ft swells. The EL LOBO, at 1200, was 200 mi west of the 990-mb center (45°N, 28°W), with 50-kn winds and 23-ft seas pounding her starboard side. Other ships were reporting 40- to 45-kn winds both to the north and south. On the 2d, the remnants of Faye disappeared. The SCHAUWENBURG, near 42°N, 32°W, had 45-kn northerly winds. She was also fighting 21-ft seas and 26-ft swells from the west-northwest. On the 3d, the LOW crossed the North Sea out of the area of interest.

Casualties--The barge CAYMAN 2200, in tow by the tug RUMPOINT, broke away in heavy weather on the 5th. The barge and many of its cargo of telephone poles washed onto a reef. The Panamanian-registered, 6,338-ton FLORIDA STATE ran aground in the river

at Tampico, on the 22d. Winds and an 8-kn current caused suspension of assistance by tugs. Tugs had to wait for high winds to abate off Veracruz, Mexico, before attempting to tow the 3,430-ton German MAGDALENE VINNEN, which had grounded on a reef in bad weather.

The 1,598-ton British-registered CAIRNROVER grounded on Lake Vaner, Sweden, on the 29th, with heavy weather in the area. A Greek tanker, the 41,964-ton PACIFIC COLOCOTRONIS sprang a leak off the coast of the Netherlands after a tank burst in rough weather.

SMOOTH LOG, OCTOBER 1975--The primary storm path to affect ships was along the U. S. East Coast toward Newfoundland and thence the Denmark Strait. Eastward moving storms from central Canada feed into this path over Nova Scotia. This basically followed the central of three climatological storm paths that move from the southwest toward the northeast. Another storm track which originated north of the Azores Islands and stretched north-northeastward toward the Faeroe Islands did not have a climatological counterpart.

The monthly mean sea-level pressure pattern closely resembled the climatological pattern, but the center was slightly more intense. The Icelandic LOW was near normally placed, near 59°N, 33°W, at 999 mb versus the climatic 1001 mb. The high-pressure ridge along latitude 30°N was about 3 mb higher in central pressure. The bubble High over West Virginia was also 3 mb higher than normal as were the pressure centers over Europe.

The anomalies were larger than the central pressures would indicate because of minor variations such as troughing and ridging. The largest negative anomaly was 6 mb south of Kap Farvel and east of Belle Isle. There was also another 6-mb center near 48°N, 30°W. There was a large positive anomaly area east of the U. S. Southeast Coast with a 4-mb center near Bermuda. The largest positive centers were 10 mb over the North Sea and the Greenland Ice Cap.

The major departure of the upper-air flow from the climatological pattern was a low center near 58°N, 38°W, with associated troughing along 35°W. This plus ridging over the western European coast resulted in a southwesterly rather than westerly flow over that area. The anomalies followed the sea-level pattern with positive values off the U. S. East Coast and over Northern Europe, and negative values over the northern waters with the center near 50°N, 35°W.

Tropical storm Hallie formed late in the month off the Carolinas. See page 63 of this issue for the annual article, "North Atlantic Tropical Cyclones, 1975."

Extratropical Cyclones--Late on the 5th, a frontal wave developed and, by the 6th, had a closed center over Cape Hatteras. It moved northeastward up the coast, and by 1200 on the 7th, gales were blowing in all but the north quadrant. At 1200 on the 8th, the 978-mb LOW was about 100 mi southeast of Cape Race. The DART AMERICA was about 100 mi south of the center with 55-kn westerly winds. The swells were 30 ft. Not far away, but about 60 mi farther south, the DANILOUGRAD and KOSMONAUT GAGARIN both were pounded by 50-kn winds and seas to 23 ft.

The storm was on a northerly track, and the HAVDRILL bored in with 50-kn winds near 54°N, 55°W, at 0000 on the 9th. The seas were 25 ft. By 1200 the pressure had fallen to 969 mb. The ANNA JOHANNE and EDITH NIELSEN, both just off Kap Farvel, had 45- to 50-kn winds. Winds of the same velocity were blowing west of the center. At 0000 on the 10th, the HESSTRASHNIJ, out of St. John's, reported 40-kn winds with 20-ft seas and 34-ft swells. The HAVDRILL had 26-ft seas. The LOW had made a small loop on the 9th and 10th near 53°N, 51°W and was filling, on the 11th, as it moved eastward. By 0000 on the 12th, the pressure had risen to 1002 mb, and there were several weak centers. On the 13th, one of these developed into the major circulation center.

A frontal system out of a Canadian LOW moved southeastward across the North-Central States. At 1200 on the 11th, a LOW formed over Maryland at the point of occlusion. As it moved off the coast, on the 12th, its circulation expanded. At 1200 on the 13th, the CAP SIDERO had a stormy 45-kn wind from the south, complete with a thunderstorm. The seas were 16 ft, and swells were 18 ft, near 39°N, 57.5°W. Just a few miles away, the EXPORT DIPLOMAT (38.9°N, 58.3°W) had 40-kn gales and the same waves. On the 14th, the center moved northward over Newfoundland. Minimal gales were common. On the 16th, the storm's center turned eastward, and early on the 17th, the ALBRIGHT PIONEER (52°N, 47°W) was about 180 mi southwest of the 976-mb center fighting 60-kn winds. At 1200, Kap Farvel reported 60-kn winds and snow. Far to the east, south of Iceland, the NEW ENGLAND TRAPPER had 40-kn thunderstorm winds. At 1200 on the 18th, the HOLENDRECHT, at 50°N, 40°W, was taking 30-ft waves on the starboard quarter of her bow. At about this time a subordinate LOW developed on the east side of the circulation. It moved northwestward, as the initial LOW moved eastward, south of it. By the 20th, the initial LOW had disappeared.

Monster of the Month--The front from the previously described LOW extended to another LOW over West Virginia on the 18th. Late in the day, a wave formed on the front south of Nova Scotia. It was below an area of upper-air zonal flow and raced eastward at about 45 kn.

By 0000 on the 20th, it was 986 mb near 42°N,

36°W. In the western quadrant, the MAGDALENE VINNEN (36.5°N, 43.5°W) was blasted by 45-kn winds, and the SPEYER (41°N, 44°W) experienced 40-kn winds. By 1200 the pressure had plunged to 962 mb at 44°N, 29°W. The HOEGH TRADER, at 46.9°N, 32.6°W, had only 41-kn winds with 8-ft seas, but 25-ft swells. Gales were blowing in all quadrants. The SPEYER was reporting regularly on her northeastward track. At 1200 she encountered devastating 46-ft seas, near 42.5°N, 41°W, although the winds were only reported as 45 kn. Not far downstream (39°N, 37.5°W), the POLARBRIS found 50-kn winds and the same devastating 46-ft seas with 49-ft swells.

At 0000 on the 21st, the LOW had continued to deepen to 946 mb. The HAHNENTOR was sailing eastward at about the same speed as the LOW, which was south of her track. As the LOW turned northeastward and continued to deepen, the winds increased. At 0000 the HAHNENTOR had 60-kn winds from the north-northwest with 39-ft seas. To the southwest, the VANCOUVER TRADER had 45-kn winds with 23-ft seas and 33-ft swells. At 1200, another ship, near 48°N, 34°W, had 55-kn winds and 30-ft seas. The HAHNENTOR was still receiving 45-kn gales and 33-ft swells. Far to the west on the edge of the storm (46°N, 40°W), the HOEGH TRADER found 55-kn winds, 12-ft seas, and 48-ft swells. The SEA-LAND CONSUMER, at 42.5°N, 25.3°W, experienced 17-ft seas and 33-ft swells.

During the 22d, the LOW was nearly stationary and slowly filling. Swells of 25 to 30 ft were still being observed west of the center. On the 23d, there were a few gale reports, and late that day the track turned northwestward. On the 24th, several centers developed, and the MAYFIELD, at 41°N, 38°W, reported hail and 50-kn winds with 33-ft swells. On the 25th, this violent storm no longer existed.

A northeast-southwest oriented front moved off the U. S. East Coast on the 30th. A large HIGH was pushing eastward over the Great Lakes. The pressure gradient west of the front was much greater than east of the front, and frontal waves were forming and dissipating. On the 31st, a ship off Cape Cod reported 40-kn winds. By 1200 an unstable wave had developed a large circulation in only a few hours. Gales were reported east and west of the front. There was a 65-kn report near 35°N, 68°W, but the wave data, cloud data, and lack of severe current weather made it suspect.

At 0000 on November 1, the 978-mb center was south of St. Mary's Bay. The BAFFIN was north of Trinity Bay with 50-kn winds and 16-ft waves. The LOW was racing northeastward and at 1200 was 974 mb. The TURANDOT was near 45°N, 45°W, and sailing into 65-kn hurricane-force winds. The wind was driving only 13-ft seas, but the swells were 41 ft. There were three reports of 50-kn or more north, west, and south of the center by the MANCHESTER CHALLENGE, OSSENDRECHT, and another ship. The MANCHESTER CHALLENGE, at 52.4°N, 46.2°W, measured 38-ft swells.

At 1200 on the 2d, the 946-mb LOW was nearing the Denmark Strait. The MANCHESTER CRUSADE was 450 mi south and gently headed into 65-kn westerlies, thunderstorms, hail, and 26-ft waves. Ocean Weather Station CHARLIE found it difficult to remain on station with 40-kn winds and 33-ft waves. At 0000 on the 3d, LIMA had the same problem with the 50-kn storm. The 30-ft seas from 260° and the 23-ft swells from 220° did not make life comfortable. At 1200 survival was most important when 60-kn winds, 33-ft seas, and 30-ft swells battered Lima.

The central pressure was rising by the 4th, and a secondary center had split off north of Iceland and was moving north along Greenland's coast. Lighter winds prevailed as the LOW stalled in the broad vicinity of 65°N, 30°W, and dissipated.

There were four reports of winds 41 kn or greater, this month, on the Great Lakes. On the 3d, the CHARLES M. BEEGHLY was on upper Lake Michigan and measured 41-kn winds and 8-ft waves. A 996-mb LOW was over lower Hudson Bay, and a large 1032-mb HIGH was centered over central Illinois. On the 6th, the BEEGHLY was on Lake Superior with 42-kn winds and 6.5-ft waves. The JOHN DYKSTRA was on Whitefish Bay and measured 46-kn winds with 6.5-ft waves. This was another LOW centered east of Hudson Bay with a cold front across the lake. Later in the month, on the 25th, yet another LOW at 984 mb was centered midway between Lake Superior and Hudson Bay. The ELTON HOYT II was on the western half of the lake riding out 44-kn winds and 18-ft waves.

Casualties--The 4,851-ton British motor vessel FURUNES, Norway for Charleston, arrived Charleston on the 10th with heavy weather damage to vessel and cargo. The Greek-registered 6,582-ton SILVER DAWN struck the north breakwater in dense fog, at Havre, on the 28th.

Smooth Log, North Pacific Weather

September and October 1975

SMOOTH LOG, SEPTEMBER 1975--An average month! The storm tracks were spread from about 35° to 70°N, but there were areas where they were more dense than others. The favorite area of concentrated cyclogenesis was eastern Mongolia, from where they tracked into Siberia or the Bering Sea. Another average track was from Honshu eastward to about 175°E, and then northeastward toward the Alaska Peninsula. This track was more eastward than the normal climatological track. Another primary track was from north of the Hawaiian Islands (35°N, 160°W) into the Gulf of Alaska. This track originated farther south than normal.

The pressure pattern overall was near the clima-

tological normal. There were two Low centers, 1006 mb over Bristol Bay and 1010 mb over the Sea of Okhotsk, which were within 2 mb of their climatological counterparts. The pressure over the western Bering Sea was above normal. The primary center of the Pacific High was 1025 mb, at 45°N, 136°W, about 750 mi northeast of its normal location. A second 1021-mb center was near 40°N, 178°W. The pressure along the North American coast, from California north, was above normal.

The major anomaly centers were positive. A plus 8-mb center was near the Queen Charlotte Islands, and an elongated north-south area of above 4 mb stretched from Wrangel Island to about 40°N, 180°. A negative 3-mb center was over the Sea of Okhotsk.

The major differences in the upper-air charts were a sharper trough southward from the Bering Strait, a sharp trough and small Low center off the California coast, and a small Low center over the Sea of Ohkotsk. The height of the 700-mb surface was above normal over most of the ocean except the Sea of Okhotsk. The primary positive anomaly centers were over the central ocean and off the British Columbia coast.

There were three tropical cyclones in the eastern North Pacific: hurricane Lily, tropical storm Monica, and tropical storm Nanette. In the western North Pacific, the tropical cyclones were typhoon Tess, tropical storm Viola, typhoon Winnie, typhoon Alice, and typhoon Betty.

Extratropical Cyclones--This LOW started out as an easterly wave and would have liked to have been a tropical cyclone. The center developed, late on the 1st, and moved northward. By 0000 on the 4th, it was near 43°N, 156°W, at 1000 mb. The PLUVIUS was near 41°N, 156°W, and found 45-kn gales. The TRANSCOLORADO was at 41.9°N, 151.3°W, at 0600, with 55-kn winds, 8-ft seas, and 28-ft swells. The storm continued moving in a north-northeasterly direction toward the Gulf of Alaska, but it was weakening. When it moved onto the Alaska coast, on the 6th, it disappeared.

This was another storm that had its inception in the easterlies south of the Pacific HIGH. This one developed, on the 5th, near 33°N, 162°E, and also moved northward prior to turning eastward on the 7th. On the 8th, it combined with a cold front moving slowly eastward. This was a shot in the arm, and the LOW quickly developed into a storm. At 0000 on the 9th, it was 999 mb at 49°N, 172°W. The GRAND GLOBE was the first to report gale-force winds, near 50°N, 176°W. By 1200, the pressure had dropped to 982 mb. The SEA-LAND MCLEAN was at 50°N, 167°W, riding with 45-kn gales, 10-ft seas, and 26-ft swells. North of the Aleutians, the SHOYO MARU suffered heavy rain, with 40-kn north winds. The 16-ft seas were from 020°, and the 20-ft swells, from 090°.

At 0000 on the 10th, the 978-mb LOW was over the Fox Islands. The JAPAN MAPLE, directly south of the center, was swept by 45-kn winds. After crossing into the Bering Sea, the forward movement of the LOW slowed considerably, and it started filling. As it moved over land, on the 11th, it again picked up speed and could be traced across Canada into the Atlantic.

This was a short-lived storm. It started as a wave on a front oriented north-south from Bristol Bay, on the 16th. It raced northward to Bristol Bay and was 982 mb on the 18th. The KIYOSHIO MARU was south of Unimak Island with 35-kn gales, while the PAC-GLORY was near 53°N, 151°W, just east of the front, with only 25-kn winds, but a southerly swell of 33 ft. The LOW moved up the Yukon River on the 19th.

Honshu contributed this storm, on the 18th. It moved eastward along the average monthly storm track. By 0000 on the 20th, the LOW was 1006 mb, near 41°N, 158°E. The EASTERN WORLD was near 44°N, 157°E, with 45-kn easterlies. At 0600, the EXPORT COURIER (41.2°N, 166.3°E) measured 50-kn winds and 15-ft seas. The LOW continued eastward, taking on a southerly component as it moved south of a HIGH over the Aleutians. The winds were averaging 20 to 30 kn around a 1000-mb center. On the 22d, they increased in speed, as indicated by the PRESIDENT HARRISON at 41.7°N, 176.6°E, which had 46-kn gales, 26-ft seas, and 33-ft swells.

On the 24th, the storm joined the eastern ocean storm track and turned northward. At 1200 on the 25th, the center passed within 60 mi of OWS PAPA, which reported 45-kn winds and 16-ft seas. A ship 200 mi south of PAPA reported 40-kn winds and 26-ft swells.

As the LOW moved into the Gulf of Alaska, it deepened dramatically, to 976 mb, based on a report by EB03. The EXXON NEWARK, at 55.9°N, 144.7°W, at 0000 on the 26th, was very near the center with 55-kn winds and 35-ft seas. At this time, the storm stalled and slowly weakened, but the NEWARK was hit by 45-kn winds, 17-ft seas, and 23-ft swells late on the 26th. By the 28th, another LOW had entered the area and gave gale-force winds and 30-ft swells to the PACIFIC WING.

While the last system was moving toward the Gulf of Alaska, this one was just beginning, south of Tokyo, on the 24th. On the 26th, its eastward movement was blocked by high pressure to the northeast. The HIGH moved east of the LOW, and the LOW moved northeastward. The RHINE MARU (41°N, 152°E) was east of the 1000-mb center (41°N, 149°E), with 40-kn southerly winds, on the 27th. The LOW tracked eastward, and, on the 30th, the TONAMI MARU, at 46.3°N, 169°W, estimated 47-kn winds. At 0000 on October 2, the ZEALAND VENTURE was about 230 mi southwest of the center, with 35-kn gales. On the 3d, the storm stalled near 55°N, 145°W, with a central pressure of 974 mb. During that time, 35- to 40-kn winds were the rule, but the GOLDEN RAY and HOWA MARU measured 45-kn winds with the latter pounded by 33-ft swells. On the 4th, the HOWA MARU still complained of 33-ft swells, and the ASIA BOTAN agreed with 30-ft swells in the southeastern quadrant. Ocean Weather Station "P" measured 25 ft at 1200.

On the 4th and 5th, a frontal wave moved around the southern and eastern periphery of the storm. At 1200 on the 5th, it was near the Queen Charlotte Islands with a pressure of 975 mb--13 mb deeper than the old LOW, which was weakening. The NEWARK, near 52°N, 132°W, was about 100 mi southwest of the center, with mild 35-kn winds and 20-ft waves. On the 6th, this LOW was the major center and rapidly weakening.

Tropical Cyclones, Eastern Pacific--Rain and an easterly wind at Acapulco, at 1200 on September 15, suggested a tropical disturbance offshore. The 1800 reports from the DEVON CITY, MARITIME ACE, and JOHAN U verified a circulation center near 16°N, 102°W, moving westward at 10 kn and forecast to be a tropical storm in 24 hr. It took only 18.

Satellite pictures included enough features to consider Lily a tropical storm, about 150 mi south of Manzanillo, by 1800 on the 16th, with winds estimated at 35 kn. Soon after forming, Lily curved slightly northwestward, slowed to about 5 kn for 30 hr, and increased in intensity to 50 kn, by 0000 on the 18th, 200 mi southwest of Manzanillo.

A west-northwesterly track continued, with no surface vessels reporting near the storm, but, at 1800 on the 18th, Socorro Island reported northeasterly winds of 30 kn, 60 to 75 mi northwest of the center. Lily was upgraded to a hurricane.

Socorro Island winds turned easterly and increased to 70 kn, at 0000 on the 19th, as Lily passed to the south and west of the island. The storm was then moving west-northwestward at about 12 kn.

That track continued as the hurricane slowly weakened to a tropical storm with 60-kn winds, at 1200 on the 20th, and to a tropical depression with 25-kn winds, 24 hr later, near 22.5°N, 126°W. The remains of Lily drifted west-southwestward in the northeast trades, and all traces of her were lost by the 24th.

Three tropical disturbances were indicated in satellite pictures, at 1800 September 27. They were centered near 13°N, 125°W, 11°N, 115°W, and 14°N, 106°W, and were followed westward at 10 kn. The disturbance that was initially near 125°W dissipated by 0600 on the 28th. The IRISH MAPLE, at 11°N, 114°W, at 0000 on the 28th, reported southwesterly winds of 10 kn and, gaining slowly on the disturbance, reported southwesterly 15-kn winds about 75 mi from the center of activity, which was estimated near 12°N, 117°W, at 0600. By 1800, the IRISH MAPLE's pressure had fallen to 1007.4 mb, at a rate of 1 mb per hr, and the wind had increased to 40 kn, indicating tropical storm Monica had formed.

The storm continued westward at about 12 kn, passing near the OCEANOGRAPHER, at 0600 on the 29th. The IRISH MAPLE reported 30-kn winds about 100 mi from the center, near 12.3°N, 123°W, at 1800 on the 29th, as Monica continued to travel on a course a little north of west. The strongest wind in the storm was 45 kn, indicated by satellite pictures at 1800, near 13°N, 123°W.

Monica continued westward to 13.9°N, 126.5°W, by 0600 October 1, when she was downgraded to a depression, and bulletins were discontinued. The disturbance continued westward, giving the WESER heavy rain and 20- to 25-kn winds on the 2d. After that, the remains could be seen in pictures, moving to 17°N, 140°W, by 1800 on the 6th. The KISHU MARU, NECTARINE CORE, and PHILIPPINE BEAR reported near the cloud cover, but suggested no circulation in their observations.

The eastern-most tropical depression, near 14°N, 106°W, at 1800 on September 27, was relocated farther south, as it became a tropical depression near 12.8°N, 107°W, at 1200 on the 28th. It moved generally westward at 8 to 10 kn and increased in intensity to become tropical storm Nanette, near 12.8°N, 110.1°W, slowing slightly and curving a little south of west.

The southern point in the track was reached, at 1200 on the 30th, near 12.2°N, 111.8°W, after which a northwesterly and westerly track at about 10 kn continued through 0600 on October 3. Gradual intensification continued to 45 kn, at 1800 October 1, and continued through 0600 on the 3d.

Weakening was as slow as the generation. Winds of 40 kn continued near the center until it reached 15°N, 122.5°W, at 0600 on the 3d, when a southwesterly track began. By 0000 on the 4th, the storm became a disturbance, near 14°N, 125°W, and bulletins were discontinued.

No vessels were near enough to the storm to report any significant weather. If it weren't for satellite pictures, it is doubtful that Nanette would have been detected.

Tropical Cyclones, Western Pacific--Typhoon Tess developed northeast of Saipan on the 2d. Moving in a northerly direction, she reached typhoon strength the following day. Tess peaked, on the 5th, as maximum winds reached 95 kn near her center, which was moving north-northwestward. At this time, tropical storm Viola was flaring up far to the southwest. Viola reached tropical storm strength, on the 6th, near 16°N, 131°E. She moved northeastward, but faded by the 7th. Meanwhile, Tess was swinging north-northeastward and losing strength, but not before mauling the OREGON with 65-kn winds and 20-ft seas, when she was about 60 mi east of the eye. She kept her typhoon winds until the 9th, and after she had crossed the 30th parallel. At 1200, the PLUVIUS reported 40-kn winds and 25-ft waves, 180 mi northeast of the center (35°N, 150°E). On the 10th, the KRYPTOS was hit by 55 kn, a few miles east of the 39.5°N, 152°E center. The HOYO MARU caught 50-kn winds after the extratropical center crossed the Kurils.

At this same time, typhoon Winnie was coming to life farther east, near 25°N, 164°E. Winnie moved northward and intensified. She reached typhoon strength, on the 10th, near 30°N, 163°E, while Tess was turning extratropical as she approached the 40th parallel. Winnie was just a minimal typhoon for about 1 day. By the 11th, she was a tropical storm again, heading northeastward. She eventually succumbed to the same fate as Tess.

A brief lull in activity was broken by Alice and Betty. Alice was first detected, on the 16th, near 14°N, 130°E, while Betty came along a day later, near 17°N, 142°E. Both moved on a general west-northwesterly course. On the 17th, Alice, nearing the Luzon coast, became a typhoon. Winds climbed to 75 kn near her center, which drove ashore later that same day. Betty was still developing and meandering westward at this time. Alice remained intact as she crossed Luzon and headed across the South China Sea. However, she fell to tropical storm strength, by the 19th, before limping across Hainan. Meanwhile, Betty had turned northwestward and was coming to life. She reached typhoon strength, on the 21st, near 21°N, 131°E, head-

ing west-northwestward toward Taiwan. Winds near her center climbed to about 100 kn before Betty barged across southern Taiwan on the 22d. She moved through the Formosa Strait and over mainland China the following day. During the typhoon, the 8,082-ton Panamanian freighter MILAN was flooded to a depth of 23 ft in her engineroom, when hit by the motorvessel EAST UNION.

Casualties--The Liberian-registered OSWEGO COURAGE requested a survey at Singapore, on the 8th, of a bulkhead fracture caused by heavy weather. The barge FLASH I, in tow of the tug RIVER EARN, from Chittagong to Kyauk Pyu, Burma, broke adrift, on the 9th, in the Bay of Bengal.

SMOOTH LOG, OCTOBER 1975--The number of cyclone tracks appeared to be slightly below normal this month. One of the primary tracks that affected shipping originated over the southern Yellow Sea or south and east of Japan. The path was generally northeastward to the Aleutians; some storms moved into the Bering Sea and others into the Gulf of Alaska. There were secondary tracks into the Gulf of Alaska and the Canadian-United States coast. Storms that came out of the Asian Continent generally dissipated before reaching the open ocean.

The overall mean sea-level pressure pattern was near the climatological mean. The centers were normally located, but the central pressures of the Highs were above normal. The 1000-mb Aleutian Low was centered over the Gulf of Alaska near its 1001-mb climatic counterpart. The Pacific High at 1024 mb was centered north and east of Hawaii. The Asian High was 3 mb higher than the normal at 1027 mb. There were two anomalous troughs, one off the coast of the western ocean and the other off the North American coast.

The anomaly centers were not especially intense. There were three significant negative centers: a 4-mb off the Canadian coast, a 3-mb centered near 43°N, 170°E, and a 3-mb over the South China Sea. There were two significant positive centers: a 6-mb near 41°N, 157°W, and a 6-mb near Mys Navarin.

The upper-air mean pattern at 700 mb was basically zonal. There was a major trough extending from the Bering Strait to Kodiak Island and thence southeastward. There were also several minor troughs to the west. A closed High of 3202 m was near 30°N, 175°W. The anomaly centers were closely associated with the sea-level anomaly centers.

There was one hurricane--Olivia--over the eastern waters. Over the western ocean, there were two tropical storms, Doris and Grace; and three typhoons, Cora, Elsie, and Flossie.

Extratropical Cyclones--The birthplace of this storm was an old weak front across the central ocean between two large HIGHs. Weak stable waves had been moving along it for several days. Late on the 3d, a different type developed, and by 0000 on the 4th, gale-force winds were blowing. The pressure was 1002 mb near 33°N, 170°E. The NORBROTT was at 37°N, 178.2°E, at 1800 with 47-kn winds.

At 0000 on the 5th, the 996-mb storm generated three reports of 50-kn winds. They were by the AMERICAN APOLLO (38°N, 174°E), the BLUE SKY (40.1°N, 178.5°E) with 30-ft seas and swells, and the TOCHIGI MARU (40.5°N, 179°E) with 20-ft swells. Twelve hours later, the HIEI MARU, 150 mi north of the center, found 23-ft waves. As the storm moved northeastward, it crossed the path of the WASHINGTON at about 0600 on the 6th, which reported 40-kn winds and 20-ft waves at 1200. Early on the 8th, the weakened storm moved northwestward across the Aleutians and was absorbed by extratropical Cora.

This was a very long-lived storm. It originated over Korea on the 7th. It gained quite a circulation as it moved over the Sea of Japan to the Tatar Strait where it stalled for 24 hr on the 9th and 10th. It also lost some of its intensity. On the 11th, it again started moving eastward and gathering strength. The first gale report was at 1200 on the 12th near 44.5°N, 159°E, east of the center. At 1200 on the 14th, a new center developed east of the old one and was to become the primary LOW within 12 hr.

By 1200 on the 15th, the new center was 970 mb at 53°N, 161°W. A ship encountered 50-kn winds along the warm front in the vicinity of 48°N, 142°W. Ocean Weather Station "P" rode out 35-kn gales. At 0000 on the 16th, the CHEVRON MISSISSIPPI was at the point of occlusion (53.5°N, 136.5°W) with 50-kn winds and 18-ft waves. Farther north the GALVESTON (57.5°N, 146.3°W) also battled 50-kn winds and 20-ft waves. The pressure was 960 mb. The circulation was now pounding the coastal mountains, and the system lost strength rapidly and could not be analyzed after 1200 on the 17th.

This storm formed over the Gulf of Alaska, on the 7th, near 49°N, 147°W. It moved eastward toward the coast. At 1800 on the 8th, the SINCLAIR TEXAS, at 48.4°N, 136.2°W, had 45-kn winds. By the 9th, the 978-mb storm was centered near 47°N, 135°W. The PHILADELPHIA, at 51°N, 131.4°W, was pounded by 45-kn winds and 25-ft waves. On the 10th, the SINCLAIR TEXAS had moved to 42.8°N, 129.1°W, and was being ravaged by 63-kn winds and 25-ft waves.

The LOW was moving against the coast on the 11th and weakening. There were no further gale reports, on the 12th, as the storm dissipated.

Reports from the NEW YORK MARU and TOYOTA MARU identified the beginning of this storm on the 14th. It was not difficult to maintain its continuity as it was moving along the major shipping lane. The first gale report on the charts was by the ROKKOHSAN MARU, at 0000 on the 16th, near 41°N, 167°E. By 0000 on the 17th, the 988-mb LOW was near 47°N, 178°E. The AGANO MARU was near 40.5°N, 173°E, with 40-kn gales and 23-ft swells. The storm's track continued east-northeastward with the highest winds plotted south of the center and west of the cold front. The PORTLAND was at 53.6°N, 135.8°W, at 1800, with 50-kn winds and 20-ft waves.

By the 19th, the 970-mb center was well into the Gulf of Alaska. The SUNBOW was sailing northeastward, near 51°N, 149°W, with 50-kn westerlies on her stern. At 0600 Ocean Weather Station "P" measured 40-kn winds and 18-ft seas. On the 20th, the storm was dissipating, but the PHILADELPHIA was hit by 40-kn starboard winds, 12-ft seas, and 30-ft swells.

At 1200, the J. L. HANNA was approaching Vancouver Island with 23-ft waves pounding her starboard side. On the 21st, the LOW no longer existed.

Ocean Weather Station "T" helped locate this storm in its formative stage on the 18th. The storm was following the Kuroshio Current. At 0000 on the 20th, the 990-mb LOW was near 41°N, 155°E. The HOTAKA MARU was slightly north of the center on the 992 isobar with 55-kn easterly winds. Twelve hours later, the AGANO MARU at 39°N, 153°E, also had 55-kn winds that had shifted to the north. The waves were running about 16 ft.

The storm was traveling northeastward at 25 to 30 kn. Several ships reported 40-kn gales. Late on the 21st, the storm crossed the Aleutians into the Bering Sea. The central pressure was now 964 mb. Adak Island measured 50-kn southerly winds, and at 0000 on the 22d, Attu Island also measured 50 kn. Several ships radioed 45 kn from all except the northeast quadrant of the storm. One of these was the ASIA BRIGHTNESS, at 49.3°N, 176.4°W, with 25-ft seas. The SHUNWIND, at 49.4°N, 175.6°W, measured 47-kn winds, 13-ft seas, and 23-ft swells.

As the LOW continued moving northeastward, it deepened to 961 mb with a tight gradient. The meteorological station at Mys Navarin reported 65-kn hurricane-force winds at 0000 on the 23d. A ship east of Saint George Island reported 40-kn winds, 16-ft seas, and 30-ft swells. A ship north of Unimak Island, which appeared to be the SHOYO MARU, reported swells of 23 ft.

As the center moved over Nunivak Island, its pressure was increasing, but Mys Navarin was still measuring 70-kn winds with a temperature of minus 14°C. The SHOYO MARU was now clearly reporting 40-kn winds, 16-ft seas, and 23-ft swells, north of Unalaska Island. When the LOW moved inland, it filled rapidly.

The Sea of Japan spawned this storm on the 28th. It raced northeastward under a tight upper-air zonal gradient. The KENJYU MARU was near 48°N, 163°E, in the warm sector, with 40-kn winds and 15-ft seas and swells. By 1200 on the 30th, the 974-mb storm was just off the Kamchatka Peninsula near 55°N, 164°E. A ship south of Ostrov Beringa reported 23-ft waves.

On the 31st, the storm intensified even more to 966 mb. The JAPAN MAPLE was near 49°N, 167°E, and sailing 90° to 45-kn westerlies and 33-ft waves. The ASIA BRAVERY (51.6°N, 174.4°E) measured 50-kn winds, 8-ft seas, and 49-ft swells. The BEL-HUDSON, at 52.7°N, 170.7°E, measured 57-kn winds, 13-ft seas, and 17-ft swells. By November 1, the storm had turned to an easterly track and the circulation had elongated in an east-west direction in response to a similarly shaped upper-air configuration. By 1200 on the 1st, a second LOW developed near the Shumagin Islands and rapidly became the major center. The TAKAO MARU found 55-kn winds near 54.5°N, 142°W, at 0000 on the 2d. The seas were 16 ft and the swells 33 ft. At 1200, the MOBILE had 40-kn winds near 56°N, 140°W. On the 3d, the AVILA fought 50-kn bow winds with 13-ft seas and 18-ft swells 30° off the seas. At 1200, the PHILADELPHIA had only 35 kn, but the seas and swells were 20 and 23 ft, respectively. The LOW stalled in the Gulf until the 5th when it dissipated.

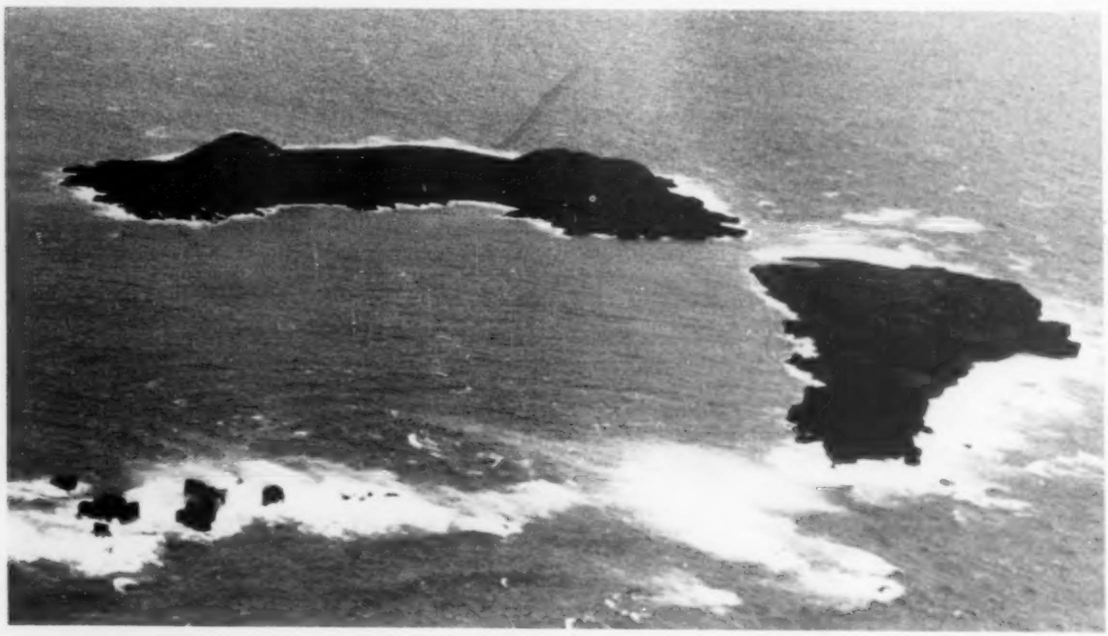


Figure 28.--A new island was created in the North Pacific when a submarine volcano erupted near Torishimo Island. Kyodo News Service.

Moderate volcanic activity had been observed on Shishaldin Volcano (54.7°N, 164°W), 2,858 m above sea level on Unimak Island, Alaska. Activity was first noticed in mid-September. Cloud cover obscured any activity until October 6 when the clouds lifted enough to reveal more activity. A nearby volcano, Pavlof, was also smoking at irregular intervals.

A submarine volcano erupted near Torishima Island of the Izu Islands, south of Tokyo on the 2d (fig. 28). The eruption was witnessed by several crewpersons and passengers of the 2,600-ton ferryboat CHICHIJIMA MARU. A red and white flaming column 30 m wide shot 40 m into the air at a point 9 km south of Torishima Island.

Tropical Cyclones, Eastern Pacific--Satellite pictures showed three concentrated areas of thunderstorm activity near 13°N, 106°W, early on October 21. By afternoon the PORTUGAL MARU and the SAPPORO MARU, with 1006-mb pressures 120 and 200 mi from the center, suggested a circulation had formed. By 0600 on the 22d, tropical storm intensity was indicated in high seas bulletins and advisories.

Further development was slow, and movement was toward the northwest at about 12 kn to near 15°N, 111°W, by 1800 on the 22d. The circulation was well developed as indicated by reports from the PORTUGAL MARU, the SOPPORO MARU, the OCEAN HAPPINESS, and Socorro Island, all about 200 mi from the center. The storm was forecast to move west-northwestward and intensify. By 0000 on the 23d, it became apparent that the track was more northerly, and at 1800, a vessel reported east-southeasterly 60-kn winds, at 16.8°N, 109.7°W, about 75 mi northeast of the center.

The tuna boat BLUE PACIFIC ran afoul of Olivia near 17°N, 110°W, at 0000 on the 24th, reporting 75-kn winds with gusts to 90 kn and the loss of much of her deck equipment from heavy seas.

The hurricane continued curving northeastward and began to accelerate. Air Force reconnaissance at 1322 on the 24th reported southeasterly 79-kn winds at 9200 ft in the southeast wall of the elliptical eye near 20°N, 109.6°W.

Northwesterly movement of the hurricane became stable at about 12 kn. The CUFIC and a Mexican Coast Guard vessel XCIN reported 50-kn winds some distance from the center as the hurricane moved toward the coast during the afternoon of the 24th.

The hurricane moved onshore between 0400 and 0600, a few miles south of Mazatlan, on the 25th. Newspapers reported 50,000 people evacuated from low-lying areas before the hurricane struck; 30,000 were left homeless in and near Mazatlan, and 500 were injured and 30 killed as a result of heavy rains and 120-kn winds. Twenty of the fatalities were crewmen of three shrimp boats which were lost. Monetary losses have been tentatively set at $20 million, $4 million of which was in the beach and tourist trade.

Reports from vessels and satellite pictures made possible the positive forecasting of the storm during the 18 hr prior to its moving onshore. While damage and suffering were considerable, without the early warning they would have been greater.

Tropical Cyclones, Western Pacific--Cora came to life on the first day of the month, about 400 mi northwest of Yap Is. She became a tropical storm on the 2d. This can be attested to by the FUOSHAN MARU, which encountered 35-kn winds in 15-ft seas at 0000. Cora was moving north-northwestward at the time, but on the 3d, as a typhoon, she swung toward the north. She continued to intensify and paralleled the Ryukyus, to the east, on the 4th. Her center remained about 100 mi off Shikoku and Honshu as Cora continued to recurve eastward. Winds near her center climbed to a peak of 110 kn, on the 5th, as she passed very close to Hachijojima Island, south of Tokyo. Wind gusts on the island reached 130 kn. Torrential downpours added to the destruction prevalent throughout the Izu Islands. Rains totaled 5 to 8 in. There were reports of three deaths, and 79 people were injured. On Hachijojima about 3,700 of the 3,800 homes sustained some damage while roads and communication facilities were also affected. The MONTANA suffered 65-kn winds and 25-ft waves at 33.1°N, 144.9°E. Cora continued rapidly eastward on the 6th and began to turn extratropical.

By 1200, Cora was considered extratropical but still a very intense storm with a large circulation. The ASIA HAWK was about 150 mi north of the center with 60-kn winds. The ALASKA MARU was about 200 mi north of the 972-mb center (42°N, 163°E) at 0000 on the 7th, with 65-kn winds and 23-ft waves. The HIEI MARU was 120 mi to the southwest and washed by 50-kn winds and rain and 33-ft waves.

At 1200, the pressure had dropped to 960 mb. The following ships were within 180 mi of the center: the TOKO MARU with 55-kn winds and 26-ft waves, the PACIFIC ARROW had 50-kn winds and 30-ft waves, and the TOCHIGI MARU had 50-kn winds and 23-ft waves. On the 8th, gales were reported all around the center, but the prizes were taken by the MEIKO MARU with 60-kn and 33-ft and the ALASKA MARU with 55-kn and 25-ft.

The storm slowly moved toward Bristol Bay where it moved across the Alaska Peninsula on the 13th and disappeared over the mainland on the 15th.

While Cora was moving along the Ryukyus, on the 4th, tropical storm Doris flared briefly in the South China Sea. She formed, about 180 mi east-southeast of Da Nang and headed northward. The following day winds near her center reached 50 kn with gusts to 65 kn, before she moved across the China coast, about 100 mi west of Hong Kong. This near miss for Hong Kong was a harbinger of things to come. On the 9th, Elsie came to life in the Philippine Sea about 200 mi north of Yap Island. She travelled west-northwestward and built into a supertyphoon--first of the year. Her course took her through the Luzon Strait on the 12th. Just before entering the Strait, her maximum winds were estimated at 140 kn. The MONTICELLO VICTORY found 70-kn winds at 19.4°N, 123.6°E. No waves were reported. With her circulation lying partly over Taiwan and Luzon, Elsie began to diminish as she moved in on Hong Kong. On the 14th, one of the busiest harbors in the world was nearly deserted as liners, freighters, and junks sought protection in the open seas and in typhoon shelters. Maximum winds were down to 80 kn by the time Elsie blew into southern China moving just south of Hong Kong, which suffered no casualties and only minor damage.

Flossie popped up on the 20th keeping things active in the South China Sea, while Grace developed in the northern part of the Philippine Sea on the 25th. Flossie had a relatively short life as she moved northward and northwestward reaching mainland China near Chan-Chiang on the 23d. She managed to attain typhoon strength just east of Hainan on the 22d as winds climbed to more than 70 kn near her center. Two ships sank in the South China Sea, and 47 crewmen were missing including 17 aboard a lifeboat. They were the KINABALU SATU and MING SING. Three of the crewmen survived more than a week in a lifeboat before rescue. Grace meandered aimlessly for several days before finally organizing into a tropical storm on the 30th near 18.4°N, 128.5°E. From here she moved northeastward, gradually turning eastward. She reached her peak on the 31st when maximum winds climbed to 60 kn. By the 2d, Grace was becoming extratropical north of Chichi Jima.

Casualties--The 3,564-ton Panamanian freighter DENPASAR (fig. 29) sank in rough seas 200 mi south of Tokyo on the 8th. The winds were up to 30 kn and the seas up to 15 ft. Thirteen crewmen were rescued by the HYOGO MARU, and 13 were missing. The same day the 446-ton MATSUSHIMA MARU sank northeast of Tokyo in 13-ft seas when engulfed by a large wave. Four of the six crewmen were rescued.

A 52-yr old woman drifted alone for a month on their yacht after her husband was lost overboard. She was rescued by the Japanese fishing vessel CHOHO MARU. The 44-ft yacht LANDFALL was taken in tow by the CHOHO MARU. The yacht had sailed from Yokosuka for Honolulu on September 2. On September 22, about 1,450 mi from Honolulu, the husband was washed overboard.

The 2,997-ton SHOTOKU MARU sank, on the 17th, in Tanon Strait, after collision with the 4,017-ton MANO No. 3. Two of the crew are missing.

The 61,054-ton Greek tanker KRITI SUN was struck by lightning at Singapore on the 28th. The ship had discharged its cargo of crude oil. The resulting explosion broke the ship's back, and the midsection sank with the bow and stern partially afloat. All crewmen and workers were rescued, but seven were injured.

Figure 29.--The Liberian-registered DENPASAR is sinking by the bow in what appears in the photograph to be very hazy weather. Kyodo News Service.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

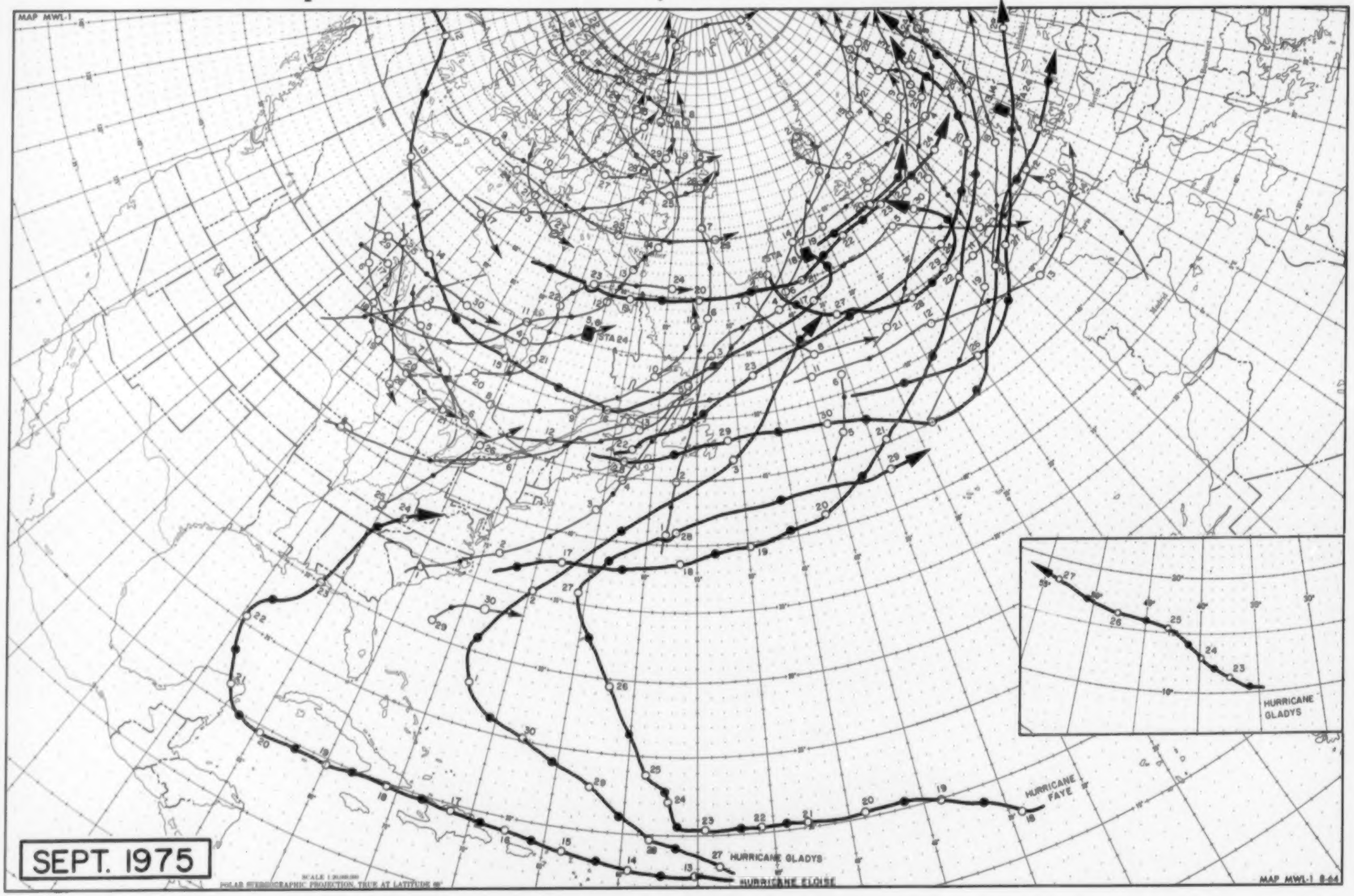


Figure 30. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

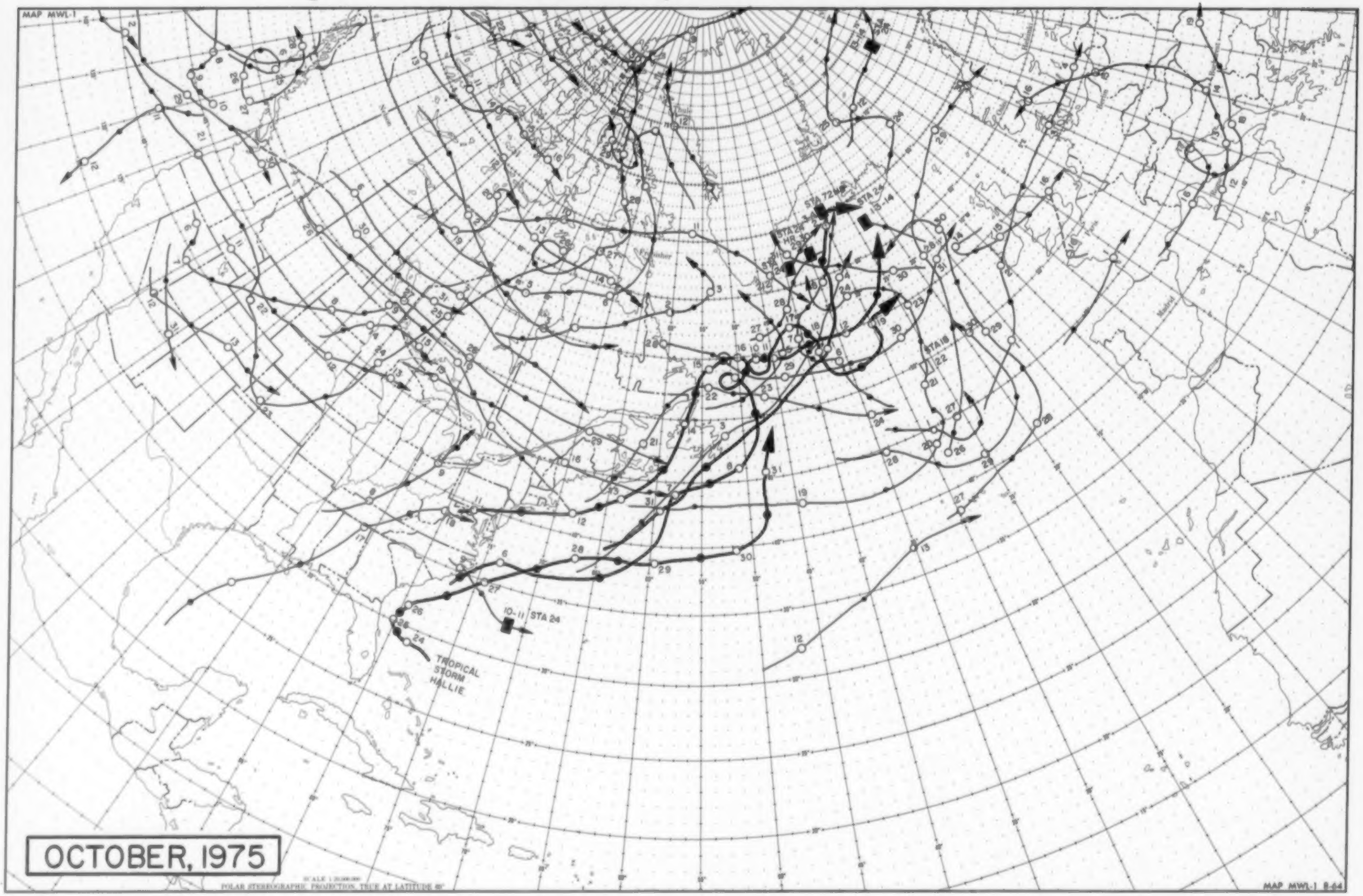


Figure 31. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

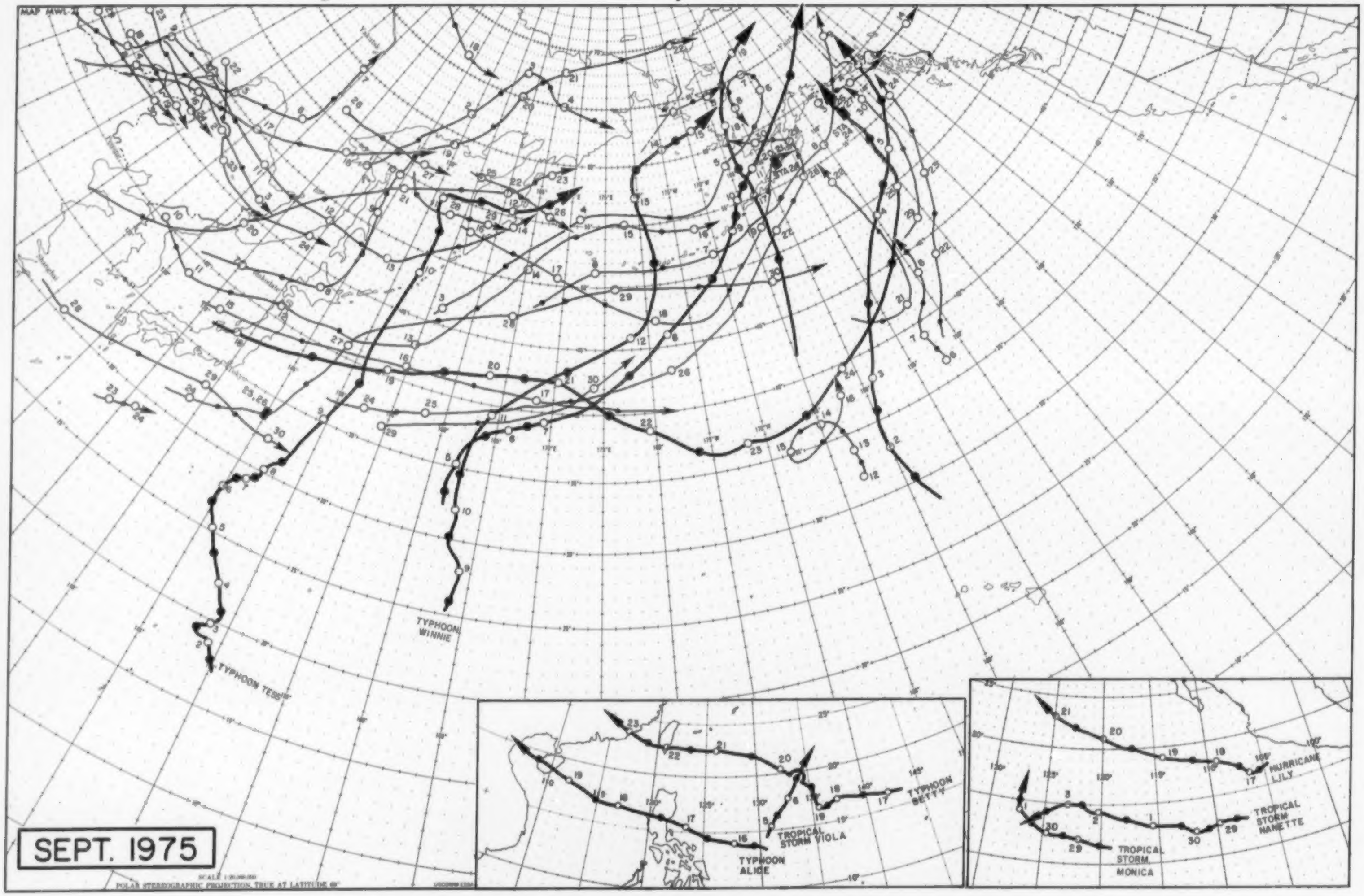


Figure 32. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

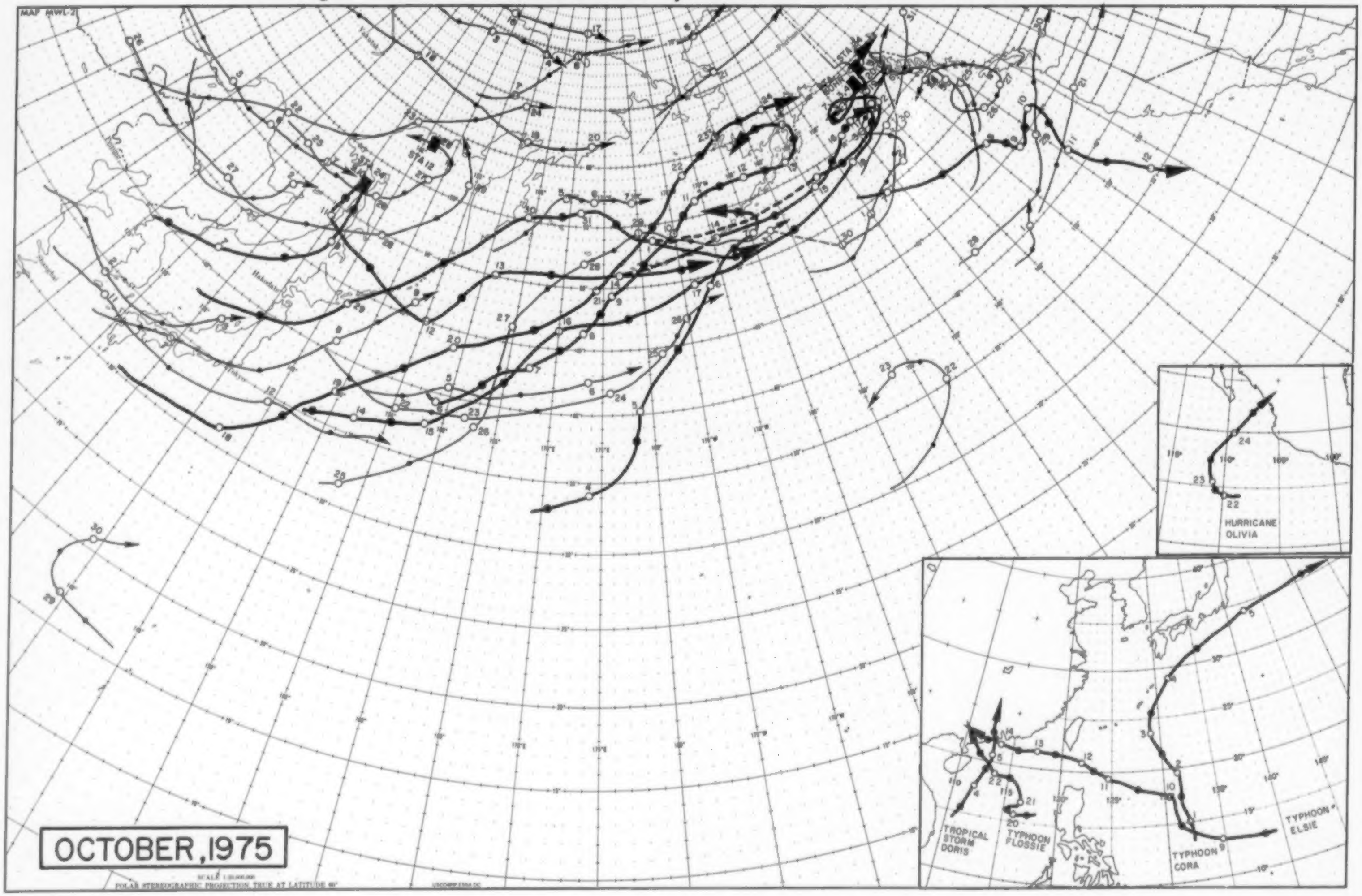


Figure 33. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Table 17

U. S. Ocean Weather Station Climatological Data, North Atlantic

Ocean Weather Station 'HOTEL' 38°00'N 71°00'W **September and October, 1975**

MEANS AND EXTREMES

MONTH	DRY BULB TEMP (°C) MIN	DA HR	MEAN	MAX	DA HR	DEW-POINT TEMP (°C) MIN	DA HR	MEAN	MAX	DA HR	SEA TEMP (°C) MIN	DA HR	MEAN	MAX	DA HR	AIR-SEA TEMP DIFFERENCE (°C) MIN	DA HR	MEAN	MAX	DA HR
SEPT	16.9	15 00	22.8	26.4	07 18	7.1	15 09	18.2	24.1	*24 12	22.2	16 12	24.5	26.3	28 03	- 6.6	*11 03	- 1.7	1.6	07 18
OCT	9.6	31 21	20.6	26.1	18 18	2.9	31 21	16.3	23.8	02 12	20.6	31 21	22.8	25.3	02 03	-11.0	*31 15	- 2.3	1.7	18 18

MONTH	MEANS AND EXTREMES: PRESSURE (MB) MIN	DA HR	MEAN	MAX	DA HR	PERCENTAGE FREQUENCY OF CLOUD AMOUNT (OKTAS): TOTAL CLOUD 0-2	3-5	6-7	8 & OBSC	LOW CLOUD 0-2	3-5	6-7	8 & OBSC	DAYS WITH SPECIFIED WEATHER: PCPN	RAIN OR DRZL	SNOW	TSTM	VSBY <1KM **	WIND (KTS) ≥34	≥48	≥64	COMP OB DAYS	MAMS WITH PCPN	NO OF OBS
SEPT	1008.4	03 00	1019.8	1031.7	15 15	27.7	29.0	25.6	17.6	65.1	25.2	6.3	3.4	11	10	0	1	0	0	0	0	29	3.4	239
OCT	1008.8	02 15	1019.0	1030.4	*05 15	11.3	27.0	31.9	29.0	48.0	29.4	14.1	8.5	17	17	0	3	0	4	0	0	31	8.5	248

** VV-90-93 AND/OR W-4 COMP OB DAYS-COMPLETE OB DAYS

Wind

SEPT WIND DIRECTIONS AND SPEEDS (% FREQUENCIES)

DIR	WIND SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL	MEAN SPEED
N	.3	2.9	11.9	.7	.0	.0	15.9	14.6
NE	.1	.9	4.7	.3	.0	.0	6.9	13.9
E	.0	2.7	10.0	.3	.0	.0	13.1	12.9
SE	.5	5.9	4.4	.1	.0	.0	10.9	9.5
S	2.4	1.8	7.0	1.5	.0	.0	12.7	13.5
SW	.0	7.1	10.6	1.0	.0	.0	18.7	12.6
W	.4	2.5	1.9	.0	.0	.0	4.8	10.9
NW	.0	3.8	9.7	1.3	.0	.0	16.0	13.9
CALM	1.7	.0	.0	.0	.0	.0	1.7	.0
TOTAL	5.4	28.9	60.3	5.4	.0	.0	100.0	12.7

NUMBER OF OBS 239; MAX WIND: DIR 260, SPEED 33, DA HR 03 1225; VECTOR SPEED .5; MEAN DIR 296 (DIR IN DEGREES)

OCT WIND DIRECTIONS AND SPEEDS (% FREQUENCIES)

DIR	WIND SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL	MEAN SPEED
N	.0	3.8	4.7	3.1	1.1	.0	12.8	17.3
NE	.0	2.6	4.8	1.9	.0	.0	9.4	15.6
E	.0	.8	10.5	1.0	.8	.0	13.1	17.5
SE	.1	.1	3.9	.8	.0	.0	4.5	16.7
S	.7	2.2	3.3	2.4	.0	.0	8.7	15.8
SW	.0	1.4	5.0	1.0	.0	.0	7.5	15.7
W	.4	5.7	12.2	1.3	.0	.0	19.7	13.6
NW	.4	3.0	7.5	9.4	.5	.0	22.8	18.9
CALM	1.6	.0	.0	.0	.0	.0	1.6	.0
TOTAL	3.2	21.8	51.6	21.0	2.4	.0	100.0	16.2

NUMBER OF OBS 248; MAX WIND: DIR 330, SPEED 45, DA HR 30 1850; VECTOR SPEED 4.5; MEAN DIR 320 (DIR IN DEGREES)

Wave

SEPT WAVE DIRECTIONS AND HEIGHTS (% FREQUENCIES)

DIR	WAVE HEIGHT (METERS) <1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	TOTAL
N	1.7	4.7	6.5	.8	.0	.0	.0	.0	13.7
NE	.0	1.0	5.9	3.9	.0	.0	.0	.0	10.8
E	.4	6.2	4.2	2.2	.0	.0	.0	.0	13.0
SE	.0	3.6	2.2	1.9	.0	.0	.0	.0	7.6
S	1.7	5.1	6.6	.0	.0	.0	.0	.0	13.4
SW	1.7	11.0	3.6	.0	.0	.0	.0	.0	16.2
W	1.9	.3	1.0	.0	.0	.0	.0	.0	3.2
NW	1.9	4.1	5.2	.4	.0	.0	.0	.0	11.6
IND	3.3	4.6	1.3	1.3	.0	.0	.0	.0	10.5
CALM	.0	.0	.0	.0	.0	.0	.0	.0	.0
TOTAL	12.6	40.6	36.4	10.5	.0	.0	.0	.0	100.0

NUMBER OF OBS 239 IND-INDETERMINATE

OCT WAVE DIRECTIONS AND HEIGHTS (% FREQUENCIES)

DIR	WAVE HEIGHT (METERS) <1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	TOTAL
N	.0	2.6	2.8	2.7	1.9	.0	.0	.0	10.1
NE	.4	4.4	4.5	2.1	.0	.0	.0	.0	11.3
E	.8	9.0	3.4	2.7	.0	.0	.0	.0	15.9
SE	.0	2.8	2.9	3.6	.4	.0	.0	.0	9.8
S	.0	3.1	5.2	2.3	.0	.0	.0	.0	10.7
SW	.0	2.6	3.1	1.0	.0	.0	.0	.0	6.8
W	.0	2.8	6.9	2.2	.0	.0	.0	.0	11.9
NW	.0	4.8	3.7	6.7	4.1	.0	.0	.0	19.4
IND	.0	2.0	2.0	.0	.0	.0	.0	.0	4.0
CALM	.0	.0	.0	.0	.0	.0	.0	.0	.0
TOTAL	1.2	34.3	34.7	23.4	6.5	.0	.0	.0	100.0

NUMBER OF OBS 248 IND-INDETERMINATE

SEPT WAVE PERIODS AND HEIGHTS (% FREQUENCIES)

PERIOD IN SECONDS	WAVE HEIGHT (METERS) <1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	TOTAL
<6	7.9	17.6	6.3	.4	.0	.0	.0	.0	32.2
6-7	1.3	13.0	20.5	.8	.0	.0	.0	.0	35.6
8-9	.0	5.4	6.7	6.3	.0	.0	.0	.0	18.4
10-11	.0	.0	.8	.0	.0	.0	.0	.0	.8
12-13	.0	.0	.8	1.7	.0	.0	.0	.0	2.5
>13	.0	.0	.0	.0	.0	.0	.0	.0	.0
IND	3.3	4.6	1.3	1.3	.0	.0	.0	.0	10.5
TOTAL	12.6	40.6	36.4	10.5	.0	.0	.0	.0	100.0

NUMBER OF OBS 239; MAX WAVE HEIGHT: HGT 3.5, PER 9, DIR 140, TYPE SWL, DA HR 02 21; IND-INDETERMINATE (DIR IN DEGREES)

*ALSO OCCURRED ON PREVIOUS OBSERVATIONS

OCT WAVE PERIODS AND HEIGHTS (% FREQUENCIES)

PERIOD IN SECONDS	WAVE HEIGHT (METERS) <1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	TOTAL
<6	1.2	17.3	6.9	.0	.0	.0	.0	.0	25.4
6-7	.0	9.7	20.2	15.7	1.2	.0	.0	.0	46.8
8-9	.0	5.2	5.6	6.5	4.8	.0	.0	.0	22.2
10-11	.0	.0	.0	1.2	.4	.0	.0	.0	1.6
12-13	.0	.0	.0	.2	.0	.0	.0	.0	.0
>13	.0	.0	.0	.0	.0	.0	.0	.0	.0
IND	.0	2.0	2.0	.2	.0	.0	.0	.0	4.0
TOTAL	1.2	34.3	34.7	23.4	6.5	.0	.0	.0	100.0

NUMBER OF OBS 248; MAX WAVE HEIGHT: HGT 4.5, PER 8, DIR 310, TYPE SEA, DA HR 13 12; IND-INDETERMINATE (DIR IN DEGREES)

For each observation, the higher wave of the sea/swell group was selected for summarization; if heights were equal, the wave with the longer period was selected; if periods were also equal, the sea wave was used.

Table 18
U. S. Ocean Buoy Climatological Data
September and October 1975

SEPTEMBER — D A T A   S U M M A R Y — EB03

AVERAGE LATITUDE 56.0N   AVERAGE LONGITUDE 147.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.4	(30 21)	10.4	14.4	(05 03)	238	30
DEWPOINT TEMP (DEG C)	04.6	(09 00)	08.7	11.7	(17 15)	238	30
PRESSURE (MBAR)	0983.6	(26 03)	1012.2	1021.0	(10 09)	237	30

DIR			
N			
NE			
E			
SE			
S			
SW			
W			
NW			
CALM			
TOTAL			

MAX WIND
SPEED: KNOTS
DIRECTION: DEG
DAY:
HOUR: :

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)   NO. OF WAVE OBS: 219

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	3.7	45.2	34.2	11.0	6.0				2.0M	5.3M	(26 03)

PRECIPITATION
NO. OF DAYS WITH PRECIP: 23   NO. OF DAYS WITH REPORTS/ COMPLETE: 28 PARTIAL: 2
NO. OF OBS WITH PAST OR PRESENT PRECIP: 97   NO. OF WEATHER OBS: 238

OCTOBER — D A T A   S U M M A R Y — EB03

AVERAGE LATITUDE 56.0N   AVERAGE LONGITUDE 147.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-00.2	(31 03)	07.2	10.6	(08 00)	246	31
DEWPOINT TEMP (DEG C)	-07.8	(30 21)	03.7	09.9	(11 21)	248	31
PRESSURE (MBAR)	0965.2	(18 00)	1000.6	1025.7	(22 21)	248	31

DIR			
N			
NE			
E			
SE			
S			
SW			
W			
NW			
CALM			
TOTAL			

MAX WIND
SPEED: KNOTS
DIRECTION: DEG
DAY:
HOUR: :

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)   NO. OF WAVE OBS: 243

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	1.2	16.9	31.3	34.2	16.0	.4			2.7M	6.0M	(26 15)

PRECIPITATION
NO. OF DAYS WITH PRECIP: 18   NO. OF DAYS WITH REPORTS/ COMPLETE: 31 PARTIAL: 0
NO. OF OBS WITH PAST OR PRESENT PRECIP: 56   NO. OF WEATHER OBS: 248

SEPTEMBER — D A T A   S U M M A R Y — EB04

AVERAGE LATITUDE 26.0N   AVERAGE LONGITUDE 090.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	22.2	(28 12)	26.5	31.4	(15 21)	162	21
DEWPOINT TEMP (DEG C)	12.2	(25 18)	21.0	25.6	(22 12)	161	21
SEA TEMP (DEG C)	25.2	(27 12)	27.8	29.8	(16 03)	158	21
AIR-SEA TEMP (DEG C)	-04.5	(20 21)	-01.4	02.1	(15 21)	155	21
PRESSURE (MBAR)	0987.4	(22 15)	1014.2	1020.5	(26 15)	164	21

WIND - % FREQUENCIES, MEANS AND EXTREMES   NO. OF OBS: 163

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		8.6	17.8	1.2	.6		28.2	13.4
NE	.6	7.4	9.2	1.2			18.4	11.4
E	1.2	13.5	9.8				24.5	10.0
SE	.6	4.9	.6				6.1	8.4
S	.6	2.5					3.1	6.4
SW		.6	1.2				1.8	10.7
W		2.5	1.2				3.7	9.0
NW	.6	1.2	5.5	3.7	2.5		13.5	21.2
CALM	.6						.6	.0
TOTAL	4.9	41.1	45.4	6.1	3.1		100.0	12.4

MAX WIND
SPEED: 47 KNOTS
DIRECTION: 300 DEG
DAY: 22
HOUR: 18

OCTOBER — D A T A   S U M M A R Y — EB04

AVERAGE LATITUDE 26.0N   AVERAGE LONGITUDE 090.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	20.6	(20 09)	24.9	28.6	(08 18)	245	31
DEWPOINT TEMP (DEG C)	11.9	(20 12)	21.1	25.9	(09 21)	242	31
SEA TEMP (DEG C)	24.1	(04 06)	25.6	27.1	(31 18)	243	31
AIR-SEA TEMP (DEG C)	-04.7	(20 12)	-01.3	00.8	(08 18)	240	31
PRESSURE (MBAR)	1005.7	(16 21)	1016.7	1022.4	(09 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES   NO. OF OBS: 246

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	4.9	8.9				14.6	11.5
NE	.8	9.8	21.1				31.7	12.4
E	1.2	10.6	11.8				23.6	11.1
SE	.4	4.5	9.8	.4			15.0	12.5
S	.8	1.6	1.6				4.1	7.7
SW	.4	.8	.8				2.0	7.8
W		1.2	.8				2.0	10.0
NW		2.0	4.9				6.9	11.9
CALM								
TOTAL	4.5	35.4	59.8	.4			100.0	11.6

MAX WIND
SPEED: 23 KNOTS
DIRECTION: 140 DEG
DAY: 16
HOUR: 06

SEPTEMBER — D A T A   S U M M A R Y — EB10

AVERAGE LATITUDE 27.9N   AVERAGE LONGITUDE 088.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	19.6	(18 06)	24.9	30.6	(19 21)	94	14
DEWPOINT TEMP (DEG C)	12.0	(28 06)	19.6	26.4	(23 03)	90	13
SEA TEMP (DEG C)	26.4	(30 15)	27.4	29.3	(19 00)	90	13
AIR-SEA TEMP (DEG C)	-06.1	(28 00)	-03.0	01.5	(17 21)	90	13
PRESSURE (MBAR)	0988.1	(23 03)	1013.3	1020.2	(26 15)	94	14

WIND - % FREQUENCIES, MEANS AND EXTREMES   NO. OF OBS: 91

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.2	2.2	31.9				36.3	13.6
NE		5.5	4.4				9.9	10.8
E			15.4	3.3	1.1		19.8	18.9
SE	2.2	5.5	1.1	2.2	1.1	1.1	13.2	17.6
S			3.3				3.3	12.7
SW	1.1						1.1	1.0
W			2.2	3.3	1.1		6.6	26.4
NW			8.8		1.1		9.9	16.6
CALM								
TOTAL	5.5	13.2	67.0	8.8	4.4	1.1	100.0	15.9

MAX WIND
SPEED: 62 KNOTS
DIRECTION: 120 DEG
DAY: 23
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)   NO. OF WAVE OBS: 90

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	39.0	45.6	7.8	6.7	6.7	1.1	2.2		1.6M	8.0M	(23 06)

PRECIPITATION
NO. OF DAYS WITH PRECIP: 3   NO. OF DAYS WITH REPORTS/ COMPLETE: 10 PARTIAL: 4
NO. OF OBS WITH PAST OR PRESENT PRECIP: 9   NO. OF WEATHER OBS: 94

OCTOBER — D A T A   S U M M A R Y — EB10

AVERAGE LATITUDE 27.9N   AVERAGE LONGITUDE 088.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	20.1	(20 09)	24.4	27.5	(26 21)	246	31
DEWPOINT TEMP (DEG C)	10.8	(20 09)	20.6	25.9	(09 18)	245	31
SEA TEMP (DEG C)	25.1	(28 12)	26.1	26.8	(10 21)	247	31
AIR-SEA TEMP (DEG C)	-05.4	(20 09)	-01.5	01.6	(26 21)	246	31
PRESSURE (MBAR)	1005.1	(17 09)	1010.6	1022.4	(05 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES   NO. OF OBS: 245

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	2.0	6.1	.8			9.8	13.3
NE	1.2	9.4	19.6	.4			30.6	12.2
E	.8	13.1	22.4				36.3	11.9
SE	.8	2.4	2.9	1.6			7.8	13.3
S		2.0	1.2	1.2			4.5	15.1
SW	.8	1.2	.8	.4			3.3	9.3
W			.8	.4			1.2	15.7
NW	.8	2.0	3.3	.4			6.5	11.3
CALM								
TOTAL	5.3	32.2	57.1	5.3			100.0	12.3

MAX WIND
SPEED: 28 KNOTS
DIRECTION: 200 DEG
DAY: 17
HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)   NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	44.2	50.8	5.0						.9M	2.5M	(17 15)

PRECIPITATION
NO. OF DAYS WITH PRECIP: 1   NO. OF DAYS WITH REPORTS/ COMPLETE: 30 PARTIAL: 1
NO. OF OBS WITH PAST OR PRESENT PRECIP: 1   NO. OF WEATHER OBS: 247

SEPTEMBER — D A T A   S U M M A R Y — EB13

AVERAGE LATITUDE 32.3N   AVERAGE LONGITUDE 075.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	22.3	(14 09)	27.1	30.7	(08 15)	236	30
DEWPOINT TEMP (DEG C)	20.1	(12 12)	24.5	27.2	(05 15)	232	30
SEA TEMP (DEG C)	26.7	(15 12)	27.9	29.0	(01 00)	216	30
AIR-SEA TEMP (DEG C)	-05.4	(14 09)	-00.9	03.5	(03 18)	214	30
PRESSURE (MBAR)	1013.8	(01 21)	1018.6	1024.6	(15 15)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES   NO. OF OBS: 238

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.3	1.3					2.5	8.2
NE	1.7	2.9	1.7	2.9			9.2	13.9
E	.8	5.9	9.7	2.1			18.5	13.2
SE		7.6	7.6	.4			15.5	10.9
S	2.5	13.0	14.3	.4			30.3	11.0
SW	.8	9.2	2.5				12.6	7.6
W		7.1	1.7				8.8	8.1
NW	1.3	1.3					2.5	5.7
CALM								
TOTAL	8.4	48.3	37.4	5.9			100.0	10.7

MAX WIND
SPEED: 34 KNOTS
DIRECTION: 140 DEG
DAY: 26
HOUR: 15

PRECIPITATION
NO. OF DAYS WITH PRECIP: 11   NO. OF DAYS WITH REPORTS/ COMPLETE: 29 PARTIAL: 1
NO. OF OBS WITH PAST OR PRESENT PRECIP: 25   NO. OF WEATHER OBS: 239

OCTOBER — D A T A   S U M M A R Y — EB13

AVERAGE LATITUDE 32.3N   AVERAGE LONGITUDE 075.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	17.2	(31 12)	24.8	29.4	(19 18)	242	31
DEWPOINT TEMP (DEG C)	10.4	(31 12)	21.4	26.5	(02 00)	240	31
SEA TEMP (DEG C)	25.8	(25 21)	27.0	28.2	(09 09)	238	31
AIR-SEA TEMP (DEG C)	-08.8	(31 12)	-02.7	02.0	(15 18)	236	31
PRESSURE (MBAR)	1010.5	(01 21)	1019.0	1026.5	(05 15)	244	31

WIND - % FREQUENCIES, MEANS AND EXTREMES   NO. OF OBS: 242

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	9.9	11.2	1.7			23.6	11.8
NE	.4	5.8	3.3	3.7			13.6	14.5
E	.8	4.1	6.6	2.1			13.6	14.1
SE		5.4	3.7				9.1	10.1
S	.4	5.8	12.0				18.6	12.4
SW	.4	2.9	3.7				7.0	10.8
W	.4	.4	2.5				3.3	11.5
NW	.4	6.2	4.5				11.2	10.0
CALM								
TOTAL	4.5	40.5	47.5	7.4			100.0	12.1

MAX WIND
SPEED: 30 KNOTS
DIRECTION: 090 DEG
DAY: 03
HOUR: 09

PRECIPITATION
NO. OF DAYS WITH PRECIP: 13   NO. OF DAYS WITH REPORTS/ COMPLETE: 28 PARTIAL: 3
NO. OF OBS WITH PAST OR PRESENT PRECIP: 27   NO. OF WEATHER OBS: 244

SEPTEMBER — DATA SUMMARY — E016
AVERAGE LATITUDE 42.5N — AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	14.1	(28 09)	15.2	17.1	(21 00)	236	30
SEA TEMP (DEG C)	14.6	(09 03)	16.3	16.8	(24 00)	239	30
AIR-SEA TEMP (DEG C)	-02.5	(02 12)	-01.1	00.7	(21 00)	239	30
PRESSURE (MBAR)	1010.6	(13 12)	1022.1	1030.2	(24 18)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 239

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	5.9	49.8	14.2			70.3	16.8
NE		1.3	8.4	.4			10.0	15.7
E								
SE								
S		1.7					1.7	7.3
SW		1.7					1.7	7.0
W		4.2	1.7				5.9	8.4
NW		5.4	3.8				9.2	9.9
CALM	1.3						1.3	.0
TOTAL	1.7	20.1	63.6	14.6			100.0	15.0

MAX WIND — SPEED: 29 KNOTS; DIRECTION: 360 DEG; DAY: 04; HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 233

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	6.9	16.3	31.3	24.5	20.2	.9			2.7M	6.0M (09 09)

SEPTEMBER — DATA SUMMARY — E033
AVERAGE LATITUDE 58.3N — AVERAGE LONGITUDE 141.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.3	(23 06)	10.7	12.4	(04 21)	201	30
SEA TEMP (DEG C)	09.5	(27 12)	11.4	13.1	(09 03)	199	30
AIR-SEA TEMP (DEG C)	-03.3	(08 15)	-00.7	00.8	(26 09)	199	30
PRESSURE (MBAR)	0992.9	(30 21)	1014.7	1028.1	(10 09)	201	30

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 200

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.5					.5	6.0
NE	1.0	1.5	1.0				3.5	7.1
E	2.0	8.0	11.0	.5	.5		22.0	11.6
SE	1.0	9.5	16.5	2.5			29.5	13.2
S	.5	6.0	9.5	.5			16.5	11.2
SW	.5	4.5	3.5	.5			9.0	10.1
W	2.5	4.5	8.5	.5			16.0	10.9
NW	.5	2.0	.5				3.0	7.0
CALM								
TOTAL	8.0	30.5	50.5	4.5	.5		100.0	11.4

MAX WIND — SPEED: 34 KNOTS; DIRECTION: 090 DEG; DAY: 26; HOUR: 03

SEPTEMBER — DATA SUMMARY — E052
AVERAGE LATITUDE 38.3N — AVERAGE LONGITUDE 074.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	14.3	(14 18)	20.1	23.0	(06 18)	105	30
SEA TEMP (DEG C)	20.2	(19 06)	22.0	24.6	(01 00)	106	30
AIR-SEA TEMP (DEG C)	-07.4	(14 18)	-01.9	00.8	(26 12)	105	30
PRESSURE (MBAR)	1012.3	(03 06)	1019.8	1039.3	(19 12)	98	30

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 103

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.9	9.7	1.0			12.6	14.8
NE	1.0	5.8	3.9				10.7	10.8
E		8.7	9.7				18.4	11.7
SE	1.0	6.8	3.9				11.7	9.3
S		3.9	9.7				13.6	11.9
SW		7.8	8.7	1.0			17.5	11.7
W	1.0	2.9	2.9				6.8	8.0
NW		1.9	6.8				8.7	12.9
CALM								
TOTAL	2.9	39.8	55.3	1.9			100.0	11.8

MAX WIND — SPEED: 22 KNOTS; DIRECTION: 350 DEG; DAY: 13; HOUR: 06

SEPTEMBER — DATA SUMMARY — E061
AVERAGE LATITUDE 28.9N — AVERAGE LONGITUDE 090.8W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	18.7	(23 12)	25.3	31.6	(12 21)	99	27
PRESSURE (MBAR)	1005.8	(22 21)	1016.4	1022.8	(20 15)	102	27

OCTOBER — DATA SUMMARY — E034
AVERAGE LATITUDE 40.1N — AVERAGE LONGITUDE 073.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.4	(31 15)	13.9	17.4	(25 15)	57	6
SEA TEMP (DEG C)	14.0	(31 21)	15.0	15.8	(25 21)	57	6
AIR-SEA TEMP (DEG C)	-09.6	(31 15)	-01.2	02.0	(25 15)	57	6
PRESSURE (MBAR)	1012.4	(25 21)	1020.5	1029.5	(31 15)	57	6

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 57

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.8	14.0	8.8			24.6	17.6
NE		3.5	7.0				10.5	11.0
E	1.8		21.1				22.8	13.9
SE		1.8	7.0				8.8	10.8
S		1.8	1.8				3.5	10.5
SW		7.0	3.5				10.5	9.8
W	1.8	14.0					15.8	6.9
NW		1.8	1.8				3.5	11.0
CALM								
TOTAL	3.5	31.6	56.1	8.8			100.0	12.5

MAX WIND — SPEED: 25 KNOTS; DIRECTION: 350 DEG; DAY: 31; HOUR: 03

OCTOBER — DATA SUMMARY — E016
AVERAGE LATITUDE 42.5N — AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.1	(27 15)	14.0	16.4	(03 21)	244	31
SEA TEMP (DEG C)	14.0	(31 21)	15.6	16.6	(01 00)	249	31
AIR-SEA TEMP (DEG C)	-05.4	(27 15)	-01.6	00.4	(17 00)	243	31
PRESSURE (MBAR)	0992.4	(10 00)	1016.0	1031.9	(29 18)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 247

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		4.0	5.3	3.2			12.6	15.3
NE	.8	2.0	.8				3.6	7.3
E		.8	.4				1.2	8.3
SE			.4				.4	15.0
S	.4	2.4	4.0	5.3			12.1	18.7
SW		2.0	17.8	6.1			25.9	18.5
W	.8	4.9	10.9	6.5			23.1	18.4
NW	.9	4.0	13.0	3.2			21.1	15.4
CALM								
TOTAL	2.9	20.2	52.6	24.3			100.0	16.4

MAX WIND — SPEED: 33 KNOTS; DIRECTION: 180 DEG; DAY: 29; HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 243

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	.4	9.5	16.0	23.9	37.0	12.8	.4		3.8M	8.0M (29 06)

OCTOBER — DATA SUMMARY — E033
AVERAGE LATITUDE 58.5N — AVERAGE LONGITUDE 141.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-00.9	(30 18)	07.8	12.1	(03 03)	221	31
SEA TEMP (DEG C)	08.0	(29 00)	09.6	11.0	(04 18)	216	31
AIR-SEA TEMP (DEG C)	-09.2	(31 18)	-01.8	01.9	(09 03)	219	31
PRESSURE (MBAR)	0976.1	(16 03)	1000.3	1023.1	(23 06)	218	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 218

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.5	3.2	2.3				6.0	10.3
NE	.9	1.4	8.7	2.3			12.8	15.9
E	1.8	4.1	8.7	7.8	.9		23.4	18.0
SE	.9	3.7	11.9				16.1	13.2
S		4.1	7.3				11.5	11.6
SW	1.4	2.8	6.9	.5			11.5	12.5
W	.5	4.6	5.0	.9			11.0	12.2
NW	.9	1.8	4.1	.9			7.8	12.8
CALM								
TOTAL	6.0	25.7	53.0	12.4	.9		100.0	14.1

MAX WIND — SPEED: 36 KNOTS; DIRECTION: 100 DEG; DAY: 16; HOUR: 03

OCTOBER — DATA SUMMARY — E052
AVERAGE LATITUDE 38.3N — AVERAGE LONGITUDE 074.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.1	(03 12)	17.4	20.5	(01 18)	66	18
SEA TEMP (DEG C)	18.1	(18 06)	19.6	21.7	(01 00)	65	18
AIR-SEA TEMP (DEG C)	-09.3	(03 18)	-02.2	01.2	(15 00)	63	18
PRESSURE (MBAR)	1011.5	(08 12)	1022.0	1032.8	(09 18)	64	18

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 65

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		6.2	12.3	1.5			20.0	15.3
NE	3.1						4.6	5.3
E		13.8	15.4				29.2	11.3
SE		1.5	1.5				3.1	11.0
S	1.5		1.5				3.1	10.0
SW	1.5	1.5	3.1				6.2	10.0
W	9.1	12.3	6.2				21.5	8.3
NW	1.5	3.1	6.2	1.5			12.3	11.0
CALM								
TOTAL	10.8	38.5	47.7	3.1			100.0	11.0

MAX WIND — SPEED: 24 KNOTS; DIRECTION: 350 DEG; DAY: 03; HOUR: 00

OCTOBER — DATA SUMMARY — E061
AVERAGE LATITUDE 28.5N — AVERAGE LONGITUDE 090.8W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	19.1	(19 12)	23.5	26.9	(15 15)	152	31
PRESSURE (MBAR)	1005.2	(16 21)	1018.7	1023.8	(03 15)	150	31

OCTOBER — DATA SUMMARY — E041
AVERAGE LATITUDE 38.7N — AVERAGE LONGITUDE 073.6W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.9	(31 09)	15.2	18.6	(29 00)	63	9
SEA TEMP (DEG C)	14.0	(31 21)	16.3	17.0	(29 21)	63	9
AIR-SEA TEMP (DEG C)	-09.5	(31 09)	-01.1	02.1	(29 00)	63	9
PRESSURE (MBAR)	1014.0	(25 21)	1020.2	1029.9	(31 15)	58	9

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 62

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.6	1.6	11.3	12.9			27.4	17.3
NE		3.2	16.1				19.4	14.2
E		8.1	11.3				19.4	10.9
SE								
S		3.2	1.6				4.8	10.0
SW		16.1	1.6				17.7	8.4
W	1.6	4.8					6.5	7.0
NW	3.2	1.6					4.8	6.0
CALM								
TOTAL	6.5	38.7	41.9	12.9			100.0	12.3

MAX WIND — SPEED: 26 KNOTS; DIRECTION: 340 DEG; DAY: 30; HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 59

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		30.5	52.5	13.6	1.7	1.7			2.2M	6.5M (31 09)

Table 19

Special Hurricane Eloise Buoy Summaries for EB04 and EB10

SEPTEMBER DATA SUMMARY EB04
AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 089.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	22.5	(23 03)	25.4	29.7	(19 10)	87	7
DEWPOINT TEMP (DEG C)	14.1	(24 18)	20.9	25.8	(22 13)	87	7
SEA TEMP (DEG C)	25.0	(24 03)	27.6	29.6	(19 21)	86	7
AIR-SEA TEMP (DEG C)	-04.5	(22 10)	-02.2	00.5	(19 18)	86	7
PRESSURE (MBAR)	0986.7	(22 13)	1008.5	1019.1	(25 06)	87	7

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.1	16.1	6.9	3.4		27.6	21.8
NE		2.3	11.5	4.6			18.4	17.5
E	1.1	2.3	3.4				6.9	11.2
SE	1.1						1.1	3.0
S								
SW								
W					2.3		2.3	38.0
NW			12.6	19.5	9.2	2.3	43.7	26.7
CALM								
TOTAL	2.3	5.7	43.7	31.0	14.9	2.3	100.0	22.6

NO. OF OBS: 87

MAX WIND
SPEED: 52 KNOTS
DIRECTION: 300 DEG
DAY: 22
HOUR: 17

Hourly Observations for Period 1200 GMT, September 19 - 1200 GMT, September 25, 1975

SEPTEMBER DATA SUMMARY EB10
AVERAGE LATITUDE 27.5N AVERAGE LONGITUDE 088.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	21.4	(26 03)	25.0	28.4	(20 15)	117	7
DEWPOINT TEMP (DEG C)	12.0	(26 06)	21.0	26.4	(20 03)	117	7
SEA TEMP (DEG C)	26.4	(24 12)	27.6	28.9	(21 00)	99	7
AIR-SEA TEMP (DEG C)	-05.5	(26 03)	-03.0	-00.4	(20 15)	99	7
PRESSURE (MBAR)	0967.8	(23 02)	1009.5	1020.4	(29 10)	117	7

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			27.4				27.4	16.0
NE		.9	3.4				4.3	14.8
E		.9	17.1	14.5	1.7		34.2	21.0
SE			1.7	2.6	4.3	2.6	11.1	27.1
S		.9		.9			1.7	19.1
SW								
W			1.7	7.7	1.7	1.7	12.8	32.9
NW			6.8		1.7		8.5	18.7
CALM								
TOTAL		2.6	58.1	25.6	9.4	4.3	100.0	22.6

NO. OF OBS: 117

MAX WIND
SPEED: 68 KNOTS
DIRECTION: 290 DEG
DAY: 23
HOUR: 04

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 99

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	3.0	40.4	17.2	11.1	18.2	7.1	3.0		2.8M	9.0M	(23 01)

PRECIPITATION
NO. OF DAYS WITH PRECIP: 3 NO. OF DAYS WITH REPORTS; COMPLETE: 1 PARTIAL: 6
NO. OF OBS WITH PAST OR PRESENT PRECIP: 23 NO. OF WEATHER OBS: 117

Hourly Observations for Period 1200 GMT, September 20 - 1200 GMT, September 25, 1975

Table 20

Selected Gale and Wave Observations, North Atlantic

September and October 1975

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves* Period sec.	Sea Waves* Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.*	Swell Waves Height ft.
NORTH ATLANTIC		SEP.															
LIGHTNING	AMERICAN	4	43.8 N	40.2 W	17	22	60 (D)	1 NM	64	1011.9	20.6	22.8	6	14.5	22	7	19.5
TAMPA	AMERICAN	16	19.2 N	66.3 W	18	13	49 (E)	1 NM	63	1011.2	25.0	27.3	3	11.5	13	6	14.5
AMPA ALLIANCE	AMERICAN	20	42.9 N	45.1 W	12	03	45	9 NM	23	1005.8	19.5	21.2	6	14.5			
GREAT REPUBLIC	AMERICAN	21	42.6 N	31.8 W	00	19	49	10 NM	02	1015.2	22.3	18.3			19	< 6	6
SOCONY VACUUM	AMERICAN	22	26.0 N	86.9 W	18	18	45 (E)	5 NM	18	1005.0	26.7	28.4	10	10	14	10	18
ATLANTIC PRESTIGE	AMERICAN	22	26.2 N	88.4 W	12	13	60 (E)	1 NM	64	998.3	25.0	28.3	8	24.5	12	10	41
EXXON SAN FRANCISCO	AMERICAN	22	26.8 N	89.0 W	17	14	73 (E)	.25 NM	82	992.2	25.0	31.1			14	12	19.5
MESS VOYAGER	AMERICAN	22	25.8 N	87.6 W	18	19	49 (E)	2 NM	64	1004.1	27.3	28.3	7	13			
T L LENZEN	LIBERIAN	23	28.6 N	86.5 W	08	15	45 (E)	5 NM	02	999.0	25.0	29.4	3	16.5			
SOCONY VACUUM	AMERICAN	23	29.6 N	88.4 W	00	18	55 (E)	5 NM	10	1005.0	27.2	27.7	10	10	16	10	16.5
EXXON SAN FRANCISCO	AMERICAN	23	26.9 N	88.8 W	00	29	70 (E)	< 50 YD	82	979.0	25.0	30.6					
ATLANTIC PRESTIGE	AMERICAN	23	25.6 N	87.7 W	00	18	45 (E)	1 NM	64	990.7	27.4	28.3		24.5	18	9	32.5
LIGHTNING	AMERICAN	26	46.1 N	35.5 W	06	33	45	10 NM	01	1007.8	13.4	13.6	5	10	33	6	13
GEORGE WALTON	AMERICAN	26	45.2 N	24.8 W	18	34	45	10 NM	15	990.0	16.2	18.9	3	6.5	31	8	11.5
AMPA RANGER	AMERICAN	26	40.2 N	23.6 W	18	36	45	5 NM	02	997.0	17.8	18.7	8	10	36	8	13
AMPA TRADER	AMERICAN	26	43.1 N	27.4 W	12	30	50	10 NM	29	1000.7	16.7	22.2			30	8	13
FERNDALE	NORWEGIAN	27	48.6 N	09.8 W	06	23	45	2 NM		987.0	14.0		9	28			
EXPORT PATRIOT	AMERICAN	27	46.7 N	18.1 W	18	25	42	5 NM	63	1000.0	16.1	10.1	4	10	24	8	19.5
GEORGE WALTON	AMERICAN	27	42.5 N	30.8 W	12	32	45	3 NM	23	1013.0	20.5	21.0			32	8	11.5
ELIZABETHPORT	AMERICAN	28	37.7 N	58.8 W	06	21	45 (F)	5 NM	18	1011.1	26.1	23.6	6	18			
EXPORT PATRIOT	AMERICAN	28	45.2 N	25.9 W	18	31	45	10 NM	15	1001.0	14.4	16.7	6	19.5	29	8	36
SEVILLAN REEFER	LIBERIAN	28	40.7 N	51.0 W	18	21	55 (F)	1 NM		999.0	24.0	17.0	XX	23			
SEALAND MARKET	AMERICAN	28	38.1 N	56.0 W	12	25	55 (F)	5 NM	02	1009.1	25.0	24.4	3	13	25	6	24.5
HAVTROLL	NORWEGIAN	29	47.6 N	42.7 W	18	10	47	.25 NM	45	994.0	14.0	18.0					
SEVILLAN REEFER	LIBERIAN	29	46.8 N	54.0 W	18	28	42	5 NM	03	1011.0	22.0	15.0	XX	19.5			
EXPORT PATRIOT	AMERICAN	30	44.1 N	41.6 W	18	30	45	5 NM	50	999.7	17.7				30	8	32.5
EXPORT AIDE	AMERICAN	30	39.4 N	27.5 W	18	24	55	2 NM	15	1006.0	22.3	21.2	XX	24.5	24	8	31
HAVTROLL	NORWEGIAN	30	49.6 N	39.7 W	12	09	48	2 NM	81	993.8	14.0	15.0			11	13	10
NORTH ATLANTIC		OCT.															
MARCONA TRADER	LIBERIAN	1	29.5 N	71.0 W	18	17	70 (G)	1 NM	20	1006.7	26.7	31.0			17	12	16.5
OVERSEAS ANCHORAGE	AMERICAN	1	43.4 N	10.6 W	00	70	45	1 NM		999.7	18.8	20.0					
HAVTROLL	NORWEGIAN	1	53.2 N	34.1 W	12	33	48	> 25 NM	01	1014.8	7.5	11.0					
CAROLINA	AMERICAN	1	25.7 N	68.7 W	00	19	48 (G)	10 NM	13	1012.2	26.2	27.8	XX	21			
AMPA ARCHER	AMERICAN	1	42.1 N	34.7 W	18	34	45	10 NM	80	1014.0	16.2	19.4	8	19.5	35	>13	24.5
EXPORT AIDE	AMERICAN	1	39.9 N	31.4 W	06	27	55	5 NM	60	1004.0	18.9	19.4	XX	29.5	27	10	39
MARCONA TRADER	LIBERIAN	2	29.3 N	71.8 W	00	19	49 (G)	1 NM	25	1011.0	26.5	31.0	3	6.5	19	12	11.5
SEALAND VENTURE	AMERICAN	2	34.1 N	68.0 W	12	18	M 50 (G)	5 NM	02	1011.2	25.6	26.7			18	8	13
EXPORT AIDE	AMERICAN	2	39.7 N	35.9 W	00	34	42	10 NM	02	1024.0	17.8	21.6			34	10	26
CAROLINA	AMERICAN	2	31.9 N	71.5 W	06	21	60 (G)	5 NM	18	1008.0	25.0	28.7	11	16.5	19	11	19.5
EXXON SEATTLE	AMERICAN	2	33.8 N	71.8 W	12	31	45 (G)	5 NM	02	1005.8	25.0	26.7					
AMPA ARCHER	AMERICAN	3	41.2 N	51.3 W	12	20	45	5 NM	50	1013.9	22.2	21.2	8	11.5	20	8	24.5
EXPORT AIDE	AMERICAN	3	39.0 N	52.1 W	18	21	45	5 NM	03	1018.0	23.9	24.4	7	14.5			
SEALAND RESOURCE	AMERICAN	4	51.6 N	38.4 W	06	23	45	2 NM	03	999.5	13.3	11.7	3	10.5	20	10	32.5
LIGHTNING	AMERICAN	8	46.4 N	44.6 W	06	16	50	5 NM	25	993.0	18.4	18.3	10	19.5	21	>13	23
SHOSHONE	AMERICAN	9	53.4 N	55.4 W	06	32	38	1 NM	73	990.5	0.5	1.7	XX	19.5			
SEALAND VENTURE	AMERICAN	13	46.9 N	12.7 W	06	18	M 50	10 NM	60	1010.2	14.4	15.6	7	8	15	9	11.5
PURE OIL	AMERICAN	17	28.0 N	07.8 W	06	15	M 48	5 NM	15	1005.8	25.2	26.7	3	8	19	9	6.5
CLEA TOPIC	LIBERIAN	20	38.5 N	33.0 W	06	28	47	5 NM	94	996.0	16.0	21.0	5	13			
HOEGH TRADER	NORWEGIAN	20	46.9 N	32.6 W	12	36	41	4 NM	03	982.0	13.0	16.0		8	36	X	24.5
RED JACKET	AMERICAN	20	41.1 N	31.6 W	06	27	45	5 NM	02	985.5	15.6	18.9	3	8	27	10	16.5
HOEGH TRADER	NORWEGIAN	21	45.9 N	40.4 W	12	33	55	2 NM		1000.0	12.0	15.0		11.5	30	X	47.5
SEALAND CONSUMER	AMERICAN	21	42.5 N	25.3 W	12	76	40	10 NM	01	987.6	17.8	19.4	6	16.5	24	7	32.5
MOBIL POWER	AMERICAN	30	37.5 N	74.1 W	18	34	45	10 NM	02	1018.6	10.0	16.7	7	10			
SAN FRANCISCO	AMERICAN	31	40.2 N	34.3 W	18	20	50	2 NM	58	990.0	21.3	25.0	5	13	16	6	11.5
GREAT LAKES VESSELS																	
CHARLES M BEEGHLY	AMERICAN	3	45.1 N	86.5 W	06	23	M 41	10 NM	02		8.0	14.0	7	8			
CHARLES M BEEGHLY	AMERICAN	6	47.3 N	86.9 W	12	33	M 42	10 NM	02		6.0	11.0	6	6.5			
JOHN DYKSTRA	AMERICAN	8	46.8 N	85.0 W	06	29	M 40	10 NM	25		12.0	13.0	7	6.5			
ELTON HOYT II	AMERICAN	25	47.5 N	89.3 W	12	27	M 44	> 25 NM	02		4.0	8.0	12	18			

(D) Hurricane Doris
(E) Hurricane Eloise
(F) Hurricane Faye
(G) Hurricane Gladys

* Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kt or waves ≥ 25 ft from May through August (≥ 41 kt or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest wind speed was selected.

Table 21

Selected Gale and Wave Observations, North Pacific

September and October 1975

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb	Temperature °C Air	Temperature °C Sea	Sea Waves† Period sec.	Sea Waves† Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.*	Swell Waves Height ft.
NORTH PACIFIC		SEP.															
TRANSCOLORADO	AMERICAN	4	41.9 N	151.3 W	06	19	55	2 NM	05	1004.7	20.0	19.4	7	8	18	8	28
BAY BRIDGE	SINGAPORE	5	51.2 N	176.0 W	00	22	M 49	.25 NM	53	1010.4	11.5	12.0	8	10			
OREGON	AMERICAN	6	29.0 N	147.4 E	18	13	50(T)	2 NM	63	993.0	26.7	28.3	XX	14.5	20	11	19.5
OREGON	AMERICAN	7	28.5 N	146.8 E	06	18	70(T)	200 YD	65	974.2	23.9	26.1	7	19.5			
DISCOVERER	AMERICAN	9	57.1 N	164.3 W	18	06	M 49	2 NM	62	996.3	6.1	6.8			06	8	10
PLUVIUS	GERMAN	9	37.5 N	150.5 E	18	14	47(T)	.5 NM	84	975.2	24.8						
SEALAND MC LEAN	AMERICAN	9	50.0 N	167.2 W	12	22	45	2 NM	21	990.8	8.9	10.0	4	10	20	8	26
ARCTIC TOKYO	LIBERIAN	10	45.9 N	154.4 E	12	16	M 50(T)	2 NM		997.1	12.0	14.0	6	19.5			
HILLYER BROWN	AMERICAN	10	59.0 N	151.3 W	12	05	45	.5 NM	65	1014.3	10.0	10.0	2	8	00	6	11.5
MONTIRON	LIBERIAN	10	45.6 N	156.3 E	18	14	M 50(T)	2 NM		992.0	14.0						
MAMMOTH PINE	LIBERIAN	10	53.9 N	162.1 W	12	18	M 45	10 NM	02	996.5	9.9	13.0	5	11.5	24	8	18
PLUVIUS	GERMAN	10	37.0 N	148.6 E	06	30	44(T)	10 NM	02	1002.5	23.0	22.0	9	24.5	31	12	29.5
NURBU	NORWEGIAN	10	42.9 N	149.1 E	06	32	45(T)	2 NM	21	986.0	13.0	10.0		16.5			
VEMA R/V	PANAMANIAN	10	42.0 N	150.0 E	00	03	60(T)	.5 NM	25	984.2	18.0	11.8			03	< 6	10
PHIL MAIL	AMERICAN	11	49.8 N	166.4 E	00	16	42	10 NM	02	1010.5	12.8	12.2	5	10	18	7	16.5
EXPORT COURIER	AMERICAN	20	41.2 N	166.3 E	06	13	M 50	2 NM	63	1017.3	18.3	20.0	6	14.5			
AMER LEGION	AMERICAN	22	21.6 N	123.4 E	00	29	64(B)	.5 NM	81	983.4	26.7	28.3	10	19.5	27	X	23
PRES HARRISON	AMERICAN	22	41.7 N	176.6 E	00	07	46	1 NM	07	1006.4	14.4	19.4	6	26	07	10	32.5
SEALAND EXCHANGE	AMERICAN	22	25.6 N	121.4 E	00	02	42(B)	10 NM	02	1004.0	27.5	25.7	8	13	04	10	16.5
EXXON NEWARK	AMERICAN	26	55.9 N	144.7 W	00	12	55	2 NM	62	980.0	10.4	10.6	7	34.5			
NEWARK	AMERICAN	26	56.1 N	142.5 W	18	22	45	10 NM	15	1002.7	8.9	9.5	+	16.5	23	8	23
PACIFIC WING	PANAMANIAN	27	46.9 N	158.1 W	18	23	M 44	5 NM	07	1000.0	14.5	18.0			23	>13	29.5
PACIFIC WING	PANAMANIAN	28	47.5 N	159.3 W	00	25	M 45	5 NM	07	1000.0	12.5	18.0			23	>13	29.5
MIDAS SEINE	LIBERIAN	29	34.2 N	164.2 W	06	29	M 47	2 NM		1000.0	13.0	12.8	4	6.5			
TUMAMI MARU	JAPANESE	30	46.3 N	169.0 W	06	27	47	2 NM	60	999.0	10.0	12.0	4	8	23	8	10
NORTH PACIFIC		OCT.															
GULDEN RAY	LIBERIAN	3	53.7 N	149.3 W	06	29	M 45	1 NM	62	980.8	8.8	10.0	6	11.5	29	9	14.5
HOWA MARU	JAPANESE	3	53.1 N	144.9 W	18	26	M 45	1 NM	63	974.0	9.0	10.0	1	6.5	26	10	32.5
NORBPUTT	NORWEGIAN	4	37.0 N	178.2 E	18	12	47	.25 NM	23	1000.0	19.0	22.0	6	14.5			
HOWA MARU	JAPANESE	4	53.3 N	146.1 W	00	26	M 32	5 NM	01	983.5	10.5	10.3	2	8	26	9	32.5
SANSINENA II	AMERICAN	4	51.4 N	137.1 W	06	23	45	10 NM	02	982.1	11.0	11.1	5	11.5	20	11	19.5
EASTERN BUILDER	LIBERIAN	4	51.4 N	160.0 W	12	32	42	5 NM	03	1012.0	7.0	10.0	10	13			
ASIA BOTAN	LIBERIAN	4	52.4 N	140.0 W	12	24	M 42	5 NM	03	994.0	10.0	10.0	8	10	24	10	29.5
REISHU MARU	JAPANESE	4	52.6 N	140.0 W	12	22	M 43	1 NM	60	992.5	8.5	11.0	4	13	22	8	16.5
NORBPUTT	NORWEGIAN	5	36.5 N	178.3 E	00	22	47	.5 NM		1002.0	20.0	22.0	6	16.5			
HOWA MARU	JAPANESE	5	54.2 N	155.7 W	18	33	M 36	2 NM		1014.0	10.0	11.0	3	11.5	33	10	32.5
MONTANA	AMERICAN	5	33.1 N	144.9 E	18	27	65(C)	2 NM	21	998.0	24.4	26.7			27	12	24.5
AMER APOLLO	AMERICAN	5	37.8 N	174.1 E	00	01	50	2 NM	16	1007.5	15.6	21.1	6	13	00	7	16.5
ASIA BOTAN	LIBERIAN	5	52.6 N	142.0 W	00	24	M 42	5 NM	03	992.0	10.0	10.0	8	10	24	10	29.5
EASTERN BUILDER	LIBERIAN	5	52.0 N	151.1 W	18	31	M 46	5 NM	02	1008.5	11.0	11.0	9	16.5	32	11	21
MONTANA	AMERICAN	6	32.7 N	146.3 E	00	31	45(C)	10 NM	16	1007.0	24.4	25.6	7	14.5	29	9	24.5
ASIA BRAVERY	LIBERIAN	6	33.2 N	149.3 E	00	26	M 41(C)	2 NM		1004.0	26.0	29.0	3	6.5	26	10	19.5
ORIENTAL ACE	LIBERIAN	7	41.8 N	166.0 E	00	19	55(C)	.5 NM	98	970.0	18.7	18.9			19	12	16.5
SINCLAIR TEXAS	AMERICAN	8	48.4 N	136.2 W	18	04	45	5 NM	60	986.5	10.6	10.6	6	11.5			
GULDEN RAY	LIBERIAN	8	51.3 N	170.4 E	12	03	M 52(C)	.5 NM	62	994.0	7.2	9.0	6	13	04	9	18
GRAND CARRIER	LIBERIAN	8	42.6 N	155.3 E	23	11	M 47	5 NM	80	1000.2	14.0	17.0					
MONTIRON	LIBERIAN	9	48.5 N	138.5 W	06	35	M 45	5 NM	02	997.5	15.0						
PHILADELPHIA	AMERICAN	9	51.0 N	131.4 W	06	12	45	1 NM	63	991.9	12.2	12.2	+	6.5	12	7	24.5
GRAND CARRIER	LIBERIAN	9	42.0 N	157.2 E	06	09	M 40	10 NM	02	1000.0	14.0	18.0					
SINCLAIR TEXAS	AMERICAN	10	42.8 N	129.1 W	00	18	63	2 NM	64	989.8	13.9	13.4			18	>13	24.5
HAWAIIAN	AMERICAN	10	45.2 N	126.5 W	12	18	45	5 NM	02	995.6	12.2	15.6	5	10			
BAY BRIDGE	SINGAPORE	10	43.3 N	136.5 W	06	32	M 47	5 NM	01	1001.0	12.3	17.0	6	10			
AVILA	AMERICAN	11	56.1 N	146.9 W	00	18	45	5 NM	62	1010.2	9.4	7.2	6	11.5			
MONTICELLO VICTORY	AMERICAN	12	19.4 N	123.6 E	00	30	70(E)	50 YD	97	995.6	26.7	28.9					
EATON GLORIA	LIBERIAN	13	45.1 N	157.5 E	18	27	M 45	5 NM	05	1008.0	10.1	13.0	3	16.5			
ASIA BRAVERY	LIBERIAN	15	47.9 N	141.6 W	18	23	M 38	2 NM	81	995.0	13.0	15.0	3	8	23	12	32.5
BURTON ISLAND	AMERICAN	15	48.1 N	142.5 W	12	19	M 48	2 NM	65	1000.1	11.5		5	10			
CHEVRON MISSISSIPPI	AMERICAN	15	52.6 N	134.5 W	18	20	45	5 NM	16	1006.2	9.4	11.1	3	8	20	10	11.5
BAY BRIDGE	SINGAPORE	15	43.6 N	171.9 W	00	25	M 52	5 NM	02	1004.2	13.0	13.3	6	11.5			
PACIFIC WING	PANAMANIAN	15	45.0 N	154.6 W	00	21	M 45	.5 NM	62	998.5	13.0	15.0	7	8	21	9	11.5
VAN ENTERPRISE	LIBERIAN	15	51.1 N	157.0 W	18	28	M 43	5 NM	62	977.0	10.0	8.0	7	14.5	28	12	18
CHEVRON MISSISSIPPI	AMERICAN	16	53.4 N	136.6 W	00	17	48	2 NM	63	987.8	10.0	11.1	4	11.5	20	9	18
NEWARK	AMERICAN	16	51.3 N	131.7 W	00	16	50	5 NM	02	994.9	10.0	12.3	6	19.5	20	10	24.5
GALVESTON	AMERICAN	16	57.5 N	146.3 W	00	18	30	5 NM	03	967.5	5.5	8.9	XX	16.5	18	10	19.5
VAN ENTERPRISE	LIBERIAN	16	50.7 N	160.1 W	12	28	M 48	2 NM	81	994.0	9.0	7.0			28	12	18
VAN FORT	LIBERIAN	17	50.7 N	178.0 W	06	05	M 45	1 NM	63	986.0	4.0	7.0					
PORTLAND	AMERICAN	18	53.6 N	135.8 W	18	18	50	10 NM	01	984.1	15.6	12.2	6	11.5	XX	X	19.5
PHILADELPHIA	AMERICAN	19	54.3 N	137.3 W	18	25	45	10 NM	02	991.5	9.4	11.1	3	6.5	23	6	18
CHEVRON MISSISSIPPI	AMERICAN	20	58.2 N	150.0 W	06	30	45	10 NM	02	997.0	4.7	11.1	4	8	29	8	13
PLUVIUS	GERMAN	20	39.2 N	152.7 E	00	26	44	5 NM	02	1009.8	22.3	22.3	9	14.5			
MASON LYKES	AMERICAN	20	34.5 N	153.2 W	06	02	42	5 NM	80	1021.0	18.7	21.7	6	13	33	8	13
SKOGSTAD	NORWEGIAN	21	44.9 N	170.7 E	06	16	42	1 NM	80	980.4	11.8	9.0					
MARCHEN MAERSK	DANISH	21	31.6 N	159.7 W	12	06	45	2 NM	80	1018.0	18.8		7	14.5			
VAN ENTERPRISE	LIBERIAN	21	47.6 N	163.9 E	00	03	M 42	2 NM	63	989.0	13.0	9.0	6	8			
SHUNWIND	LIBERIAN	21	48.0 N	175.0 E	06	15	M 45	1 NM	63	998.4	9.8	13.0	5	13			
ARCTIC TOKYO	LIBERIAN	22	53.6 N	172.2 E	06	32	M 48	.25 NM	25	995.0	7.0	8.0	10	11.5			
ASIA BRIGHTNESS	LIBERIAN	22	49.3 N	176.4 W	00	17	44	1 NM	63	989.0	10.0	10.0	7	24.5			
SHUNWIND	LIBERIAN	22	49.4 N	175.6 W	18	27	M 47	10 NM	01	1009.4	6.1	10.0	6	13	27	>13	23
PORTLAND	AMERICAN	23	57.5 N	146.8 W	00	23	45	10 NM	02	1022.0	8.3	10.0	4	10	23	6	14.5
AMER LARK	AMERICAN	23	36.0 N	155.2 E	00	32	M 44	5 NM	03	1005.4	17.8	21.1	6	13			
ASIA BRAVERY	LIBERIAN	26	54.0 N	140.6 W	12	31	M 38	2 NM		1007.5	6.0	10.0	3	11.5	31	7	32.5
BELHUDSON	BRITISH	26	34.1 N	148.0 W	18	30	M 43	10 NM	01	1009.0	6.0	8.0	3	16.5			
AVILA	AMERICAN	26	56.8 N	147.8 W	12	32	30	10 NM	02	1008.8	5.6	8.1	3	13	34	9	19.5
OCEANOGRAPHER	AMERICAN	26	09.4 N	150.9 W	06	08	M 44	5 NM	02	1007.1	22.0	26.9	2	5	06	< 6	10
YAMASHIN MARU	JAPANESE	29	37.0 N	129.3 W	06	21	M 43	5 NM	01	1009.5	17.0	18.0	6	10	19	7	13
SINCLAIR TEXAS	AMERICAN	29	59.0 N	152.0 W	18	01	45	> 25 NM	02	1002.5	- 4.4	6.7	3	8			
ATITLAN	SWEDISH	29	40.5 N	132.2 E	00	36	45	5 NM	04	1017.5	5.0	16.0	9	16.5			
ARCO SAG RIVER	AMERICAN	29	45.3 N	130.9 W	18	36	45	10 NM	01	1001.0	11.0	12.7	6	10			
ASIA BRAVERY	LIBERIAN	31	51.6 N	174.4 E	12	23	M 50	2 NM	27	990.0	5.0	7.0	4	8	23	>13	49
BELHUDSON	BRITISH	31	52.7 N	170.7 E	06	23	M 57	5 NM	70	983.0	4.0	6.0	4	13	23	6	16.5

(T) Typhoon Tess
(B) Typhoon Betty
(C) Typhoon Cora
(E) Typhoon Elsie

\+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kt or waves ≥ 25 ft from May through August (≥ 41 kt or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest wind speed was selected.

Rough Log, North Atlantic Weather

December 1975 and January 1976

ROUGH LOG, DECEMBER 1975--The centers of the LOWs that crossed the North Atlantic tended to hug the coasts. The primary track that affected shipping moved along the coast of the United States to southern Greenland and through the Denmark Strait toward northern Norway. Other major tracks were from Hudson Bay into Baffin Bay and the northeastern United States into the Davis Strait. There was an area of anomalous storm centers in midocean and off the coast of Morocco. Even though a ship may not have encountered the center of the storm, many ships experienced heavy weather many miles from the center as is usual with extratropical storms. The primary storm tracks were shifted slightly west of their climatological position.

The monthly mean sea-level pressure pattern differed greatly from the climatological mean (fig. 34). The Icelandic Low normally straddles Iceland with two centers of about 1000 mb, one south of the Denmark Strait and the other over the Norwegian Sea. This month the primary Low was 985 mb and centered over the Barents Sea. A secondary 1004-mb Low was over the Davis Strait. The Azores High was 1032 mb and near 50°N, 20°W, about 800 mi north-northeast of its usual 1021-mb position. The pressure over the eastern United States was slightly higher than normal. An inverted trough reflected the LOWs over the midocean.

The anomaly chart reflected the pressure differences very dramatically (fig. 35). There was a negative 23-mb center associated with the shifted Icelandic Low west of Novaya Zemlya. The Azores High was reflected by a positive 21-mb center near 52°N, 20°W. Another negative 9-mb center was near 30°N, 32°W, as a result of the inverted trough.

The upper-air pattern over eastern North America was near normal with a low center over Baffin Bay. The primary circulation center was over the Arctic Ocean northeast of Spitzbergen. An anomalous closed High was centered near 48°N, 24°W, resulting in a sharp southeast-oriented trough along the Labrador Coast and into the central ocean. As a consequence, the wind flow was more northerly over the western ocean north of 40°N, and more southerly over the Norwegian and North Seas. The gradient was also much tighter.

Extratropical Cyclones--The first major storm of the month developed over Lake Michigan, on the 2d, and moved offshore over Nova Scotia on the 4th. As it moved over the warmer water, gales were generated in the southwestern quadrant. At 0000 on the 5th, the 990-mb LOW was near 46°N, 53°W, and the EURO-FREIGHTER was sailing into 45-kn westerlies near 42°N, 58°W. The seas were 21 ft. On the 1200 chart,

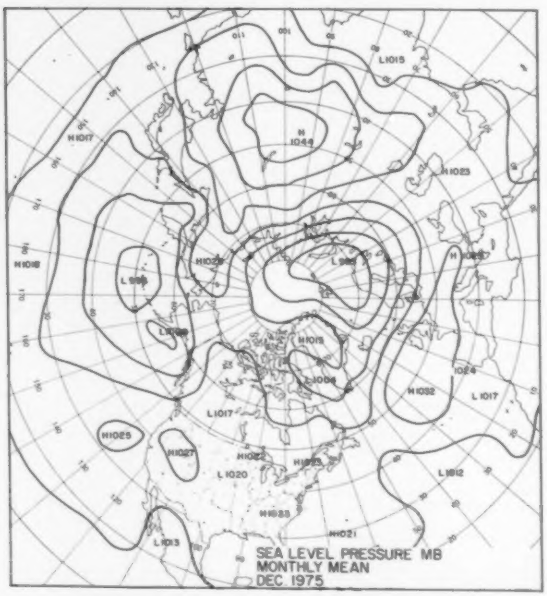


Figure 34.--The Icelandic Low and the Azores High are both much stronger than their climatological counterparts and displaced many miles from their normal location.

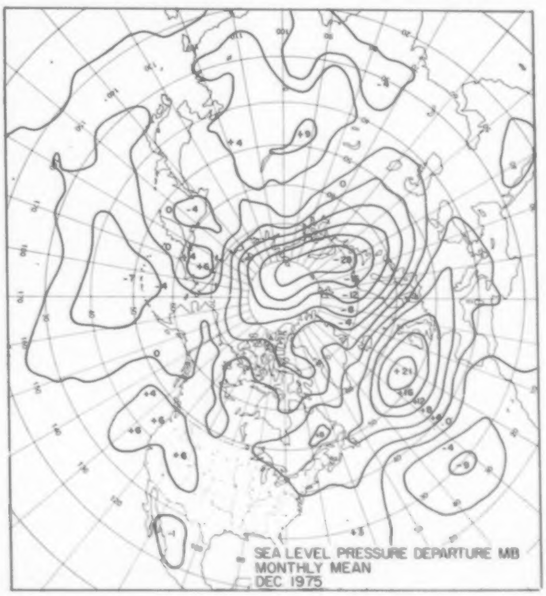


Figure 35.--The intense anomaly centers reflect both the displacement of the pressure centers and their central pressures from the climatological mean.

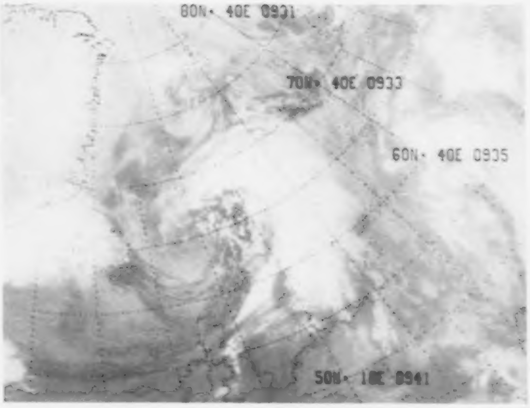


Figure 36.--The center of the LOW is not readily apparent in this satellite image earlier in the day. Only the high cold clouds stand out. The low warmer clouds are the gray tones.

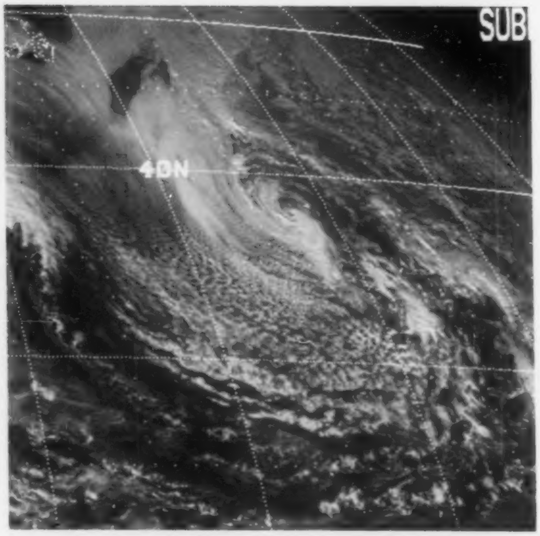


Figure 37.--At this Sun and camera angle, at 1700, the storm has the circular appearance and eye of a tropical rather than the extratropical cyclone it actually is.

the DART ATLANTIC reported 40-kn winds and 23-ft swells near 44°N, 50°W.

By 1200 on the 6th, the 993-mb LOW had raced to 64°N, 30°W. The MATHILDE SCHULTE, at 57°N, 37°W, found 45-kn winds. Late on the 6th, the storm moved over Iceland with gale-force winds. By 1200 on the 7th, the LOW had dropped to a pressure of 968 mb near 68°N, 10°E (fig. 36). The NORDLAND, at 62.5°N, 10°W, was fighting 65-kn hurricane-force winds with 36-ft seas and 39-ft swells. The sky was partly cloudy. The RO was north of the Shetland Islands with 50-kn winds. The LOW moved over northern Scandinavia, on the 8th, bringing high winds to coastal areas along the North Sea and Baltic Sea.

As the previous storm moved northward, on the 5th, it left an area of weak gradient (col) along the front between two large HIGHs. On the 0000 chart of the 6th, a 1008-mb LOW had formed near 34°N, 44°W. The HIGH moving off the U. S. East Coast continued moving eastward, and the gradient tightened on the west side of the LOW producing gales. By 1200, the pressure had dropped to 997 mb, and the SEA-LAND CONSUMER encountered 50-kn winds, about 140 mi southwest of the center, along with 20-ft seas and 33-ft swells. Twelve hours later, the HECTOR also fought 50-kn winds and 21-ft waves on her port side.

The LOW was quasi-stationary near 38°N, 50°W, as the HIGH to the northeast remained stationary. The East Coast HIGH moved southeastward with decreasing pressure, and a large Canadian HIGH approached from the northwest. On the 9th, gales were reported in all quadrants.

At 0000 on the 10th, the NEW ENGLAND TRAPPER and the WESER EXPRESS, both northwest of the center, had 50-kn northerly winds. The SUGAR TRANSPORTER, at 44°N, 50.1°W, was plotted as having 39-ft swells from 350°. At 1200 (fig. 37), the BRUNSKAMP, near 39°N, 43°W, and only about 60 mi from the LOW's center, reported a 60-kn northwesterly wind. At 0000 on the 11th, the NEW ENGLAND TRAPPER was near 48.5°N, 40°W, with 60-kn northeasterly winds, 25-ft seas, and 31-ft swells.

The LOW was drifting southward with little change in intensity, but on the 12th, it circled to a northerly movement again and started filling. On the 14th, it split into two small centers. The PALLUS reported 45 kn and the EREW 60 kn near the center near 38°N, 38°W.

While the LOW described above was rotating around in the central ocean, a front moved off the U. S. East Coast. A wave formed on the front on the 12th. The DAWSON, east of the front (41°N, 58°W), was hit by 45-kn southerly winds. As is usual in meteorology, the unusual happens, and the frontal wave moved southeastward. The DART ATLANTIC was near 41°N, 55°W, at 0000 on the 13th, northwest of the 997-mb center pounding into 50-kn winds and 26-ft swell waves. At 1200, the DOCTOR LYKES (34°N, 56°W) logged 50-kn winds, and the BRITISH COMMODORE (36.5°N, 55°W) logged 40-kn winds with 31-ft seas. The winds in the northwest quadrant continued to blow up to 50 kn, and seas to 26 ft were reported by two vessels (fig. 38).

On the 14th, the LOW split into two centers, and another frontal wave formed near 45°N, 43°W. Winds of 40 to 50 kn were soon blowing around the new center. The ATLANTIC CONVEYOR was at 50°N, 46°W. The wind was 50 kn, the seas 16 ft, and the swell 30 ft. On the opposite side of the LOW, at 49°N, 40°W, the PIRAN had 45-kn southerly winds and 23-ft seas. This LOW became the primary LOW as the southern one filled and moved to the east and northeast.

Again, contrary to normal movement, this LOW tracked southward and then southeastward. At 1200 on the 16th, there was a ship report with the swell height coded as 25 (41 ft), but it was questionable.

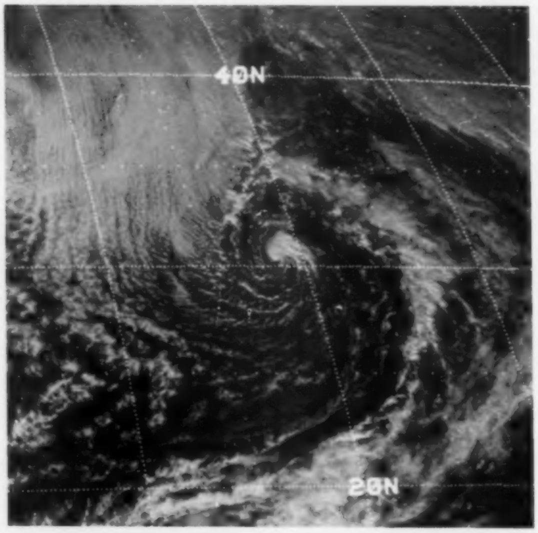


Figure 38.--The higher winds and seas are associated with the nearly overcast cloud cover of the northwest quadrant. The cloud streets are indicative of the turbulent conditions.

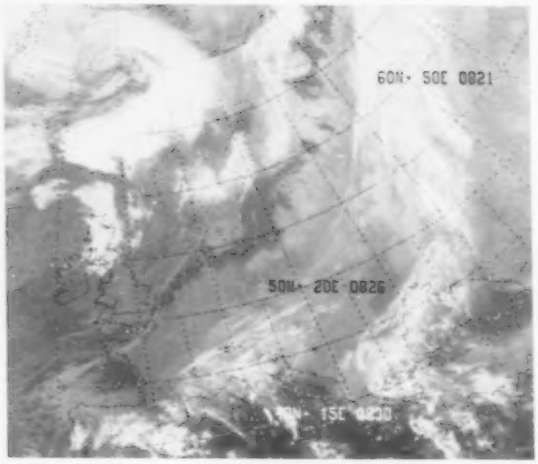


Figure 39.--The LOW is centered north of the Arctic Circle in continuous darkness, but it can be seen by the infrared sensor of the polar-orbiting satellite. The large HIGH is centered on the left edge of the image near 53°N, 19°W.

Several other ships reported 20-ft swells. At 0000 on the 17th, the 990-mb LOW was near 36°N, 43°W. Winds of 40 and 45 kn were reported south and east of the center.

The LOW continued to drift southeastward. At 1200 on the 19th, the STAR FJELLANGER (35°N, 31.5°W) radioed 55-kn winds. Twenty-four hours later (1200/20), the ROBERT TOOMBS (34°N, 34°W) was sailing into 40-kn gales. The LOW was still drifting in the gross vicinity of 32°N, 32°W, on the 23d, when the CINULIA found 50-kn winds with 33-ft seas near 39°N, 33°W. On the 24th at 0000, the ACT 1 found 50-kn winds and 23-ft waves at 34.7°N, 34.9°W. No other high wind or wave reports were received prior to dissipation of the LOW on the 27th.

Part of the explanation for the persistence of these LOWs over the central ocean was an upper-air cutoff LOW which persisted much of the month. To explain why it was there, if possible, would require more space and time than is available here.

A deep LOW moved out of Canada through the Davis Strait and into Baffin Bay on the 12th. On the 13th, a LOW formed on the old front in the Denmark Strait. A 1045-mb HIGH was centered near 54°N, 22°W, an extremely strong and unusual position for high pressure this time of the year. A tight gradient on the north side was producing strong winds. Four stations on Iceland reported 35- to 40-kn winds. Ocean Weather Station Mike reported 40-kn winds and 20-ft seas. The ISAKOGORKA, at 65°N, 05°E, radioed 45-kn winds, as did an island station off Norway.

By 1200 on the 14th, the 956-mb LOW had traveled to 71.5°N, 01°E (fig. 39). A ship near 66°N, 02°E, reported 25-ft seas. Ocean Weather Station Mike reported 45-kn winds and 33-ft seas at 0000 on the 15th. A ship, near 71.5°N, 17°E, was blasted by 60-kn winds of 2°C. The storm moved across Nordkapp with strong winds to all of Scandinavia.

This storm formed and moved along the Atlantic seaboard on the 26th. At 0000 on the 27th, the 999-mb center moved over northern New England with the front paralleling the coast. It was west of Ocean Weather Station Hotel which reported 40-kn winds and 20-ft seas. The storm moved across Belle Isle on the 28th. Gales were blowing, especially east of the front. The LOW, which was now 976 mb, moved south of Iceland on the 29th. At 1200, Ocean Weather Station Lima logged 45-kn winds and 26-ft seas. Twelve hours later at 0000 on the 30th, Lima was still bravely battling 20-ft seas and 26-ft swells. By 1200, the highest waves had decreased to 23 ft. On the 30th, the storm was over the Norwegian Sea and moved over Scandinavia bringing 23-ft waves to Ocean Weather Station Mike.

Casualties--The POLA DE LAVIANA, a 9,950-ton motorship under construction at Gijon, Spain, was reported, on the 18th, to have broken her moorings during a storm and received heavy damage when she collided with a quay. The IMBROS, a 3,426-ton Cypriot freighter radioed that she was in distress 250 mi east of Savannah, Ga. When last heard from, the ship reported fighting 60-kn winds.

A collision in fog on the Elbe River resulted in a 400-ton river barge sinking, a West German coastal vessel capsizing, and slight damage to the 10,122-ton Polish motorship MIECZYSLAW KALINOWSKI. During the last week, the 10,614-ton Somali motorship SINYEH caught and grounded during stormy weather off Latakia, Syria.

ROUGH LOG, JANUARY 1976--The over-water movement of the low-pressure centers closely approximated climatology. An exception to this was along the U. S. Southeast Coast, as most of the storm centers moved offshore over the middle Atlantic Coast rather than farther south as is usual. The storms formed farther north than usual with the Great Lakes region supplying more than normal. The storms over the Great Lakes moved easterly rather than the usual northeasterly. The average track would be from central Illinois to New Jersey, then gradually arc to a point about 100 mi off Cape Race, and then to Iceland and the Norwegian Sea.

There were many differences in the mean monthly pressure pattern. Normally, the Icelandic Low consists of two centers with the primary center east of Kap Farvel. This month, the lowest center was over the Norwegian Sea where the secondary center is normally located. Both pressures were lower than climatology. The 995-mb center was near 70°N, 10°E, and the 997-mb center was near 62°N, 30°W. The Azores High at 1029 mb was at 42°N, 20°W, about 10° of latitude north of its 1020-mb climatic position. A secondary 1025-mb center was near 32°N, 50°W.

Of course, the anomaly centers closely matched the pressure centers. A negative 10 mb was near 70°N, 10°E, a negative 5 mb near 65°N, 25°W, and 60°N, 80°W. A major part of the North Atlantic from 20° to 60°N was covered by positive anomaly values as was the United States.

The upper-air pattern was normally located. The significant difference being that the troughs and ridges were more intense. This was accentuated by a high center off Spain near 40°N, 20°W. As with the surface, the major part of the open ocean was dominated by positive anomaly values.

Extratropical Cyclones--Monster of the Month--This was the worst storm to strike northwestern Europe in 29 yr according to a British spokesman. On New Year's Day, a front stretched east-west along approximately 50°N. A frontal wave formed and moved eastward across the United Kingdom and the North Sea late on the 1st. At 1200 on the 1st, another LOW formed just south of Iceland, and another wave was moving northeastward out of midocean.

At 1200 on Friday the 2d, there were two LOWs, a 990 mb near 62°N, 12°W, and a 985 mb near 55°N, 10°W. The MANCHESTER CHALLENGE (52°N, 15°W) and the SEA-LAND RESOURCE (50°N, 20°W) were both near the front with 45-kn gales. Their highest seas were 18 ft and swells 25 ft. Gales were reported on

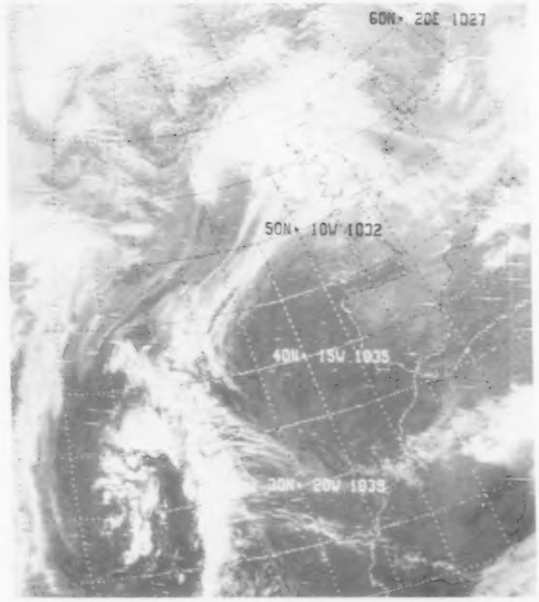


Figure 40.--The LOW, near 56°N, 13°W, is already bringing gales to the Irish Coast as a harbinger of the vicious winds a few hours later.

the southwest coast of Ireland (fig. 40).

At 0000 on the 3d, the two LOWs had combined near 59°N, 05°E, at 972 mb. Strong winds with gusts to 90 kn were blowing across England and all the countries bordering the North Sea. The high winds wracked havoc by blowing down trees, roofs, buildings, and power lines. Fifty-five people were killed, including 26 in Britain and 12 in West Germany. The high waves and tide damage were even more spectacular. At Liverpool, a $2.5 million prefabricated concrete ferry landing stage was washed away. Waves 60-ft high crashed onto Britain's East Coast. Flooding caused 20,000 Danes in southwestern Jutland to evacuate their homes. Winds up to 70 kn were reported as far south as Vienna.

Winds, waves, and tides were responsible for the grounding or sinking of many ships and the flooding of many harbors. See figures 41 and 42. At least 20 ships in or near British waters were in trouble. The 1,373-ton Cypriot NORTH STREAM was torn from its moorings in the Elbe River. The 16 crew members were rescued by helicopter. A small West German ship was blown aground, and two others collided in the Kiel Canal. The 20,000-ton tanker MYRNA at an English port was ripped from her moorings and was refloated after grounding. The East German coastal freighter CAPELLA sank in the North Sea with 11 crew members missing. Seven Norwegian fishermen were missing after the FRITZ ERICK sank off Senja Island. The Singapore-registered GABBRO sank in the Kiel Canal.

By 1200 on the 3d, the 972-mb LOW had moved into the southern Baltic Sea, but it was still lashing the area with powerful winds. Inland stations were re-

Figure 41.--The Elbe River and Hamburg's harbor are flooded from the storm. The house is normally on dry ground between the river and the dock. Wide World Photo.

Figure 42.--The Dutch freighter STARDUST would appreciate some of the flood water from the Elbe to refloat her from the beach. She was grounded between 's Gravenzande and Hook of Holland by the severe winds that swept the North Sea. Wide World Photo.

cording prevailing 35-kn winds. By 0000 on the 4th, the LOW was over Poland and later in the day raced into Russia.

A high-pressure area off the U. S. East Coast broke down rapidly, on the 12th, and a LOW developed south of Cape Cod. At 1200, the CORALSTONE was near the cold front at 38°N, 64°W, plowing into 45-kn gales and 20-ft seas on her port bow. The 994-mb LOW was near 44°N, 52°W, at 1200 on the 13th, and the VGBZ was at 43.4°N, 60.1°W, with snow showers and 45-kn winds. The MORILLO was near 39°N, 60°W, with 40-kn winds, 16-ft seas, and 33-ft swells.

Multiple centers had now commenced to develop with the northern ones racing off toward the northeast and dissipating. On the 14th, several ships reported gales up to 45 kn and seas to 23 ft. Among these were the AMERICAN LEGACY and the ATLANTIC CROWN.

On the 15th, the LOW was rapidly weakening as it was squeezed by a HIGH near Lands End and another LOW over Labrador.

This storm was assembled in the Oklahoma storm factory on the 13th. It deepened and intensified very rapidly as it raced northeastward to near 46°N, 72°W, at 1200 on the 14th. At that time it was 983 mb and had been moving with a speed of approximately 45 kn. Ships were already finding gales off the mid-Atlantic Coast. Sixty-knot gusts were reported on Cape Cod at Chatham (fig. 43). At 0000 on the 15th, the LOW was over Anticosti Island. The VGBZ, still near 43°N, 60°W, was tossed by 60-kn southwesterly winds and 20-ft waves. The LASH ESPANA (38°N, 59°W) was farther south with 40-kn gales but 23-ft waves. At 1200, the CRYOS was in the Strait of Belle Isle with 50-kn winds, and in this confined area had 16-ft waves. The LOW reached its minimum pressure of 970 mb at 0000 on the 16th. It moved north into the Labrador Sea to disappear in the fjords of southwest Greenland.

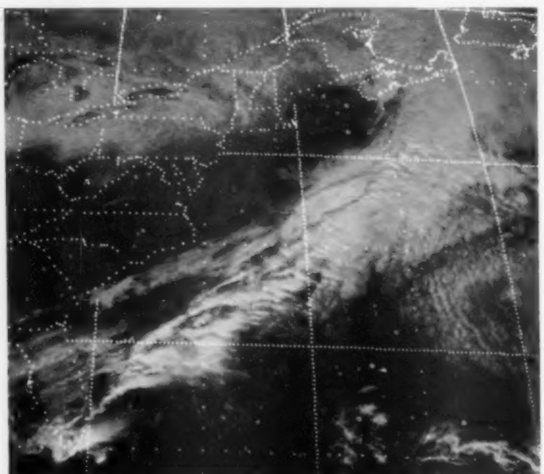


Figure 43.--At 1700 on the 14th, the storm is centered over New Brunswick, and the front is well off the New England Coast. The 60-kn winds over Cape Cod are blowing in cloudless skies.

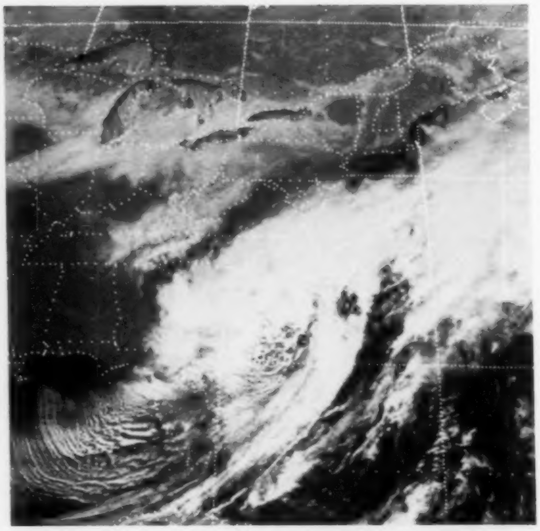


Figure 44.--This storm off the Carolinas looks vicious even in this still picture. The cloud streets in the cold northerly circulation over the Gulf of Mexico are very sharply defined.

This was a complex system of LOWs. Originally, a storm system moved across the Great Lakes on the 16th. As the leading edge of the circulation moved over the water, another LOW developed south of Nantucket Island, moved northeastward, and became the major circulation. To the south, along the front, a wave developed over South Carolina, on the 17th (fig. 44). At 1200, the VGBZ reported 55-kn winds south of Sable Island.

The South Carolina LOW intensified rapidly over the Gulf Stream and became the major storm. At 0000 on the 18th, the 980-mb storm was near 36°N, 70°W, Ocean Weather Station Hotel measured 45-kn winds and 18-ft seas. There were seven reports of 40-kn winds in various quadrants of the storm. The ships with wave heights included the ELBE EXPRESS (25 ft), GUAYAMA (21 ft), JACKSONVILLE (33 ft), MAYAGUEZ (13 ft), and ROBERT E. LEE (25 ft).

By 1200 on the 18th, the 986-mb LOW was at 45°N, 61°W. The VGBZ was now measuring 60-kn winds with 23-ft seas as the front neared. Farther south, the SCHAVENBURG was tossed by 60-kn winds and 25-ft waves along the front. Not far away, near 36°N, 64°W, the DUMBAIA was ravaged by winds of only 50 kn, but the swells were reported as 49 ft. East of the front near 40°N, 55°W, the EXPORT LEADER was pounded on the port side by 50-kn winds and 30-ft waves. Back near the center, the ATLANTICA LIVORNO fought 33-ft swells from the south. Another ship in the vicinity of 29°N, 67°W, reported a "violent electric storm plus wind shift from S to WSW at 1015."

The storm was being squeezed by two large HIGHs, and on the 19th, the Nantucket LOW moved up the southwest coast of Greenland while the South Carolina LOW quickly disappeared.

As the LOW mentioned above moved west of Kap Farvel, a 970-mb LOW formed off the East Coast. The pressure gradient between the LOW and a 1041-mb HIGH near 44°N, 30°W, was very tight. Ocean Weather Stations Charlie and Lima measured 20-ft waves and the SKIENSFJORD had 23-ft seas. At 1200 on the 19th, the LOW was 950 mb off Keflavik. The GODAFOSS (59.5°N, 29°W) fought 50-kn winds, and the LINDA DAN (61°N, 21°W) 45 kn. Lima now had 40-kn winds, 20-ft seas, and 23-ft swells.

The wind flow between 50° and 60°N was nearly straight from coast to coast, and although not as strong as the gradient would indicate, it produced high waves as a result of the long fetch. The SKIENSFJORD reported 26-ft seas, Charlie, 23-ft swells, and Lima, 30-ft seas and 36-ft swells, at 0000 on the 20th.

At that time, a new LOW formed off the coast of Norway, and at 1200, another LOW appeared south of the Denmark Strait with the LOW over Iceland disappearing from the analysis. The LINDA DAN still had 25-ft seas, and Lima now measured 50-kn winds, 30-ft seas, and 41-ft swells (fig. 45). Gales lashed the British Isles from Scotland to the South Coast, causing at least four deaths and possibly damage into the millions of pounds. On the 21st, Lima still had 34-ft swells, and her swell reports continued to be

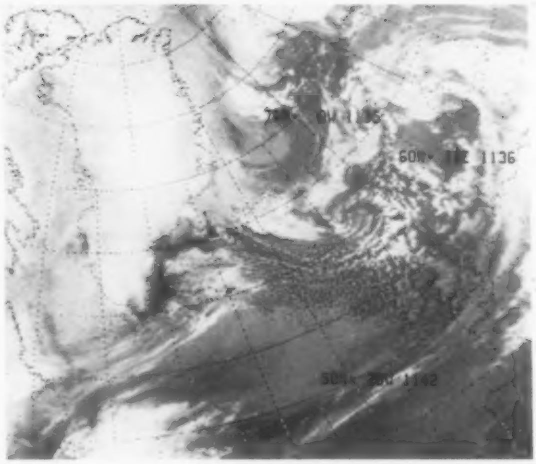


Figure 45.--A circulation which was not reflected on the surface analysis is indicated near 62°N, 08°W. The strong zonal flow from the Labrador Sea to the North Sea can be visualized from the picture.

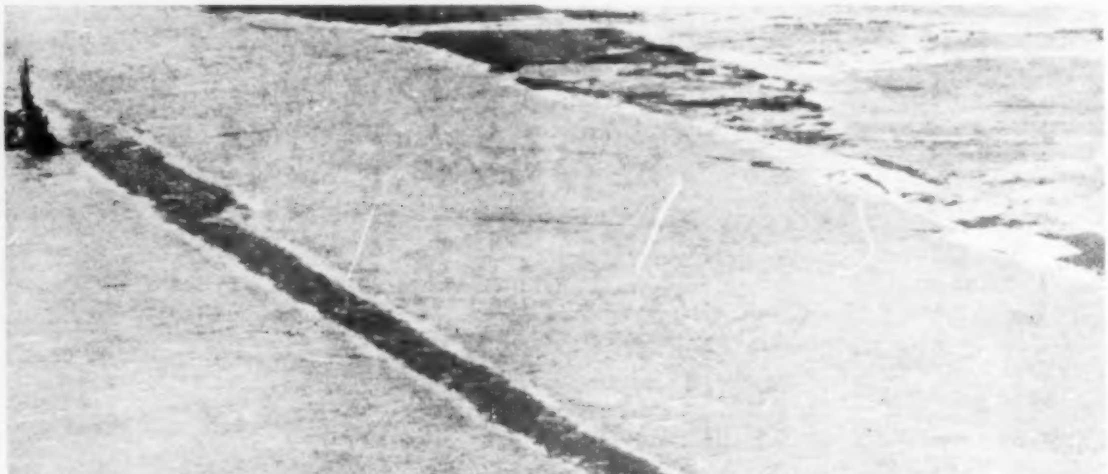


Figure 46.--A tugboat pulls a tanker through ice on Chesapeake Bay opposite Baltimore. Farther north, two Coast Guard cutters broke through ice 3 to 10 in thick while leading a convoy. Wide World Photo.

over 20 ft until the 24th.

A storm developed off Long Island on the 22d. By 1200, it was over Nova Scotia at 975 mb. Gales to 45 kn were reported south of the center and west of the cold front. These included Ocean Weather Station Hotel and the USCGC EVERGREEN. At 0000 on the 23d, five ships radioed 40-kn winds in the area bounded by the coast, 35°N, and 60°W. At 0900 and 1200, OWS Hotel had 50-kn winds, with 31-ft and 25-ft seas, respectively.

As the LOW moved northward up the coast, a HIGH was centered over central Canada, and the northerly flow between them fed extremely cold air from the Arctic into the eastern United States. The Chesapeake Bay froze, with ice up to 10 in thick in the northern part (fig. 46). Coast Guard cutters broke through the ice to lead a convoy out of Baltimore on the 23d.

During this same time, the Azores High was moving northward and building. By 0000 on the 24th, the LOW had moved northwestward to near Ungava Bay, and one cell of the HIGH was centered between Kap Farvel and Iceland at 1047 mb. Two small LOWs had developed near Newfoundland. Four ships were battered by 40-kn gales south of the southern LOW. One was the MARIE LEONHARDT with 26-ft waves. Farther north along the front, the NEW ENGLAND TRAPPER (48°N, 45°W) had 50-kn winds. At 1200, the HIGH was 1050 mb near 60°N, 23°W.

On the 25th, the LOW was over Baffin Island and the HIGH was retreating southward and decreasing in pressure.

This was a multinational, intercontinental storm. It was first analyzed, late on the 25th, over the lower Ohio River, and moved northeastward over Lake Huron to northern Quebec on the 27th. It had remained a rather weak storm until moving over the Labrador Sea. By 1200 on the 28th, its pressure had plunged to 968 mb near 58°N, 31°W, but only weak gales had been reported.

Twelve hours later, the situation changed rapidly. The LOW now at 954 mb was near 56°N, 24°W. At this time, Ocean Weather Stations Charlie and Lima both measured 50-kn winds and 26-ft and 21-ft waves, respectively. The ERNST KRENKEL, near 49°N, 28°W, also fought 50-kn winds and 30-ft seas.

The storm was really pounding ships, on the 1200 chart of the 29th, with high waves (fig. 47). Ocean Weather Station Romeo survived 46-ft seas. The POLYARNYY KRUG (45°N, 26°W) fought 55-kn winds and 36-ft swells, the GEEST-TIDE 60-kn winds and 23-ft swells, and several other ships battled 20- to 25-ft waves, including OWS Lima. On the 30th, the high winds and waves were continuing. Ocean Weather Station Romeo was still battling 50-kn winds, and now the seas were 49 ft. The CAROLA REITH, at 46.4°N, 26.1°W, also contended with 50-kn winds, but the swells were only 33 ft. The ERNST KRENKEL now reported 28-ft swells.

The LOW was moving southeastward at 974 mb at 1200 on the 30th. Ocean Weather Station Romeo measured 40-kn winds and 46-ft seas. The GANYMEDES (44°N, 19°W) had 40-kn winds, 18-ft seas, and 34-ft swells. The FROSTFJORD (41°N, 19°W) had 50-kn winds with no seas reported, and the VALYA KOTIK (44°N, 13°W) reported only 30-kn winds with 30-ft

Figure 47.--At 1022 on the 29th, the LOW is near 53°N, 23°W. High winds and seas south of the center pounded OWS Romeo.

seas. The 28,673-ton motor vessel IVY loaded with iron ore ran aground in heavy weather outside the harbor at Vigo, Spain, on the 30th. On the 31st, the vessel broke in two, and the bow section sank immediately. All crew members abandoned ship and were safely ashore.

On the 31st, the LOW entered the Bay of Biscay slowly filling but still producing high swell waves. The CHIKUZEN MARU and OWS Romeo reported 23-ft and 30-ft waves, respectively. A HIGH was centered over Scandinavia, and the easterly flow between the LOW and the HIGH brought western Europe its most severe cold wave in 4 yr.

On February 1, the storm was over the Mediterranean Sea and for the next 3 days tracked eastward over that body of water with no significant winds reported.

Casualties--Early in the month, the 1,568-ton Cypriot vessel EVDOKIA K. was holed and beached to prevent sinking after a collision with the 13,392-ton Indian vessel JAG DOOT, in heavy fog, off Canakkale in northwestern Turkey. The 30,510-ton West German bulkcarrier BERNHARD OLDENDORFF went aground in heavy rain at mile 169.5 of the Orinoco River.

On the 24th, the 250,000-ton tanker OLYMPIC BRAVERY (fig. 48) developed engine trouble and was forced onto the rocks of Ushant Island by heavy seas. The same seas prevented immediate refloating, and she was holed. The newly built vessel was in ballast headed for lay up in Norway.

Figure 48.--The OLYMPIC BRAVERY is hard aground on the rocks of Ushant Island off Brest, France. The ship was on its first trip, in ballast, to be laid up in Norway when it developed engine trouble and was forced onto the rocks by heavy seas. Wide World Photo.

Rough Log, North Pacific Weather

December 1975 and January 1976

ROUGH LOG, DECEMBER 1975--The number of cyclone centers traversing the North Pacific was above normal this month. The primary tracks were shifted south and east of their normal location and less concentrated. The average track of most concentration begins at latitude 35°N near Japan, to 40°N in midocean, to the Gulf of Alaska. Early and late in the month, there were three cyclones that tracked south of latitude 30°N prior to turning northeastward near midocean.

The mean pressure pattern over the North Pacific was more normal than in the North Atlantic. The Aleutian Low had two centers--996 mb and 1000 mb--versus 1002 mb and 1001 mb as indicated by climatology. They were over the southern Bering Sea and the Gulf of Alaska, respectively. The Pacific High was 1025 mb, near 35°N, 130°W, versus 1020 mb near 30°N, 130°W, according to climatology.

The most significant negative anomaly was 7 mb near 50°N, 175°W, indicating the lower pressure and slight displacement of the Aleutian Low over the Bering Sea. The higher pressure and northward shift of the Pacific High resulted in a large area of positive anomaly off and over the northwestern United States with several 6-mb centers. A smaller 6-mb positive anomaly was north of Kamchatka over eastern Siberia.

The upper-air flow was mainly zonal between latitudes 30° and 50°N from Japan to longitude 160°W. East of 160°W, the flow turned northeastward to pass over a ridge over the Rocky Mountains. There was a 59-m (194 ft) negative anomaly center near 50°N, 175°W, and a 65-m (214 ft) positive anomaly center near 43°N, 124°W.

There were no tropical cyclones this month.

Extratropical Cyclones--This was one of the storms that formed and tracked south of latitude 30°N. It formed on the 2d and tracked eastward, turning northeastward on the 3d. The first gales were reported on the 4th. The EASTERN MARINER (32°N, 166°E) and the MILENA (31.5°N, 173°E) both reported 40-kn gales and waves of 16 ft.

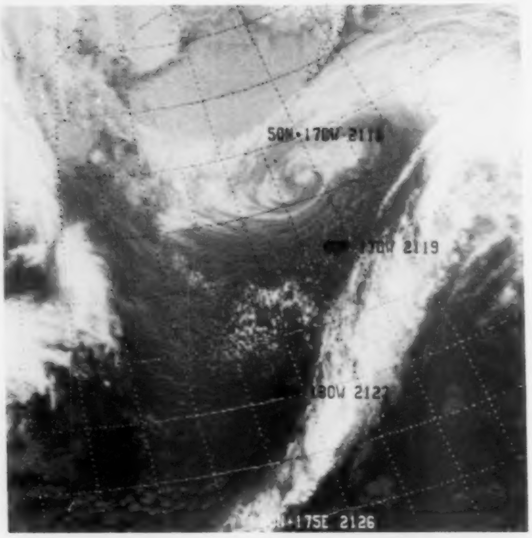


Figure 49.--The most dangerous part of the storm was well east of the center according to the ship reports.

There were isolated gale reports as the storm traveled northeastward. At 0000 on the 6th, the 977-mb storm was centered near 48.5°N, 171°W (fig. 49). The BELMAR was many miles to the east, near 52°N, 158°W, sailing with 50-kn easterlies and 33-ft waves. The NICKOLAY KARAMZIN (46°N, 151°W) was east of the front with 40-kn southerly winds and 20-ft seas. Gales were blowing south of the center with seas to 20 ft. The storm crossed the Gulf of Alaska on the 8th and was lost near Sitka.

When the last storm dissipated over the mountains of British Columbia, a weak LOW was left behind in the Gulf of Alaska. On the 12th, a front extending from a LOW over the Bering Sea was incorporated into its circulation and brought new energy. At 1200 on the 12th, the LOW was 992 mb. The PORTLAND was near the center, at 57°N, 144°W, with 45-kn winds. At 0000 on the 13th, the TOYO MARU (52.5°N, 135.5°W) had 50-kn winds and 26-ft seas and swells. The AVILA, at 53°N, 139°W, was fighting 45-kn winds and 20-ft seas. The storm had been moving south along the coast and by 1200 had pounded itself out on the rocky coast.

Monster of the Month--For the first half of its life, this LOW followed the average primary storm path. It then turned more northward than the mean track and into the Bering Sea. It formed on the 11th southeast of Tokyo. On the 12th, there were reports of 40-kn winds on each side of the center. The SEA-LAND RESOURCE was west of the center, at 37°N, 148°E, with 16-ft waves. At 1200 on the 13th, the 980-mb LOW was near 40°N, 167°E. The KURE MARU, near 37.5°N, 165°E, had 50-kn winds, 20-ft seas, and 34-ft swells striking her starboard side. At 0000 on the 14th, the AMERICAN APOLLO, 600 mi south of the center, found 40-kn winds and 25-ft swells. Near the center and north of it, the DATAN MARU battled 50-kn winds, while the KATORI MARU fought 55-kn winds. At 1200, the HARUNA MARU, near 39.5°N, 176.5°E, 550 mi south of the 954-mb center, was barely making headway into 55-kn winds, 12-ft seas, and 39-ft swells. Twelve hours later, she still had the same winds and seas, but the swell had dropped to 30 ft (fig. 50).

About 1200 on the 15th, the LOW crossed into the Bering Sea near Adak. There were many gale reports but no especially high winds and waves reported. The same applied on the 16th and 17th. On the 18th, the LOW stalled near 57°N, 175°W, and gradually filled as other storms moved south of the Aleutians.

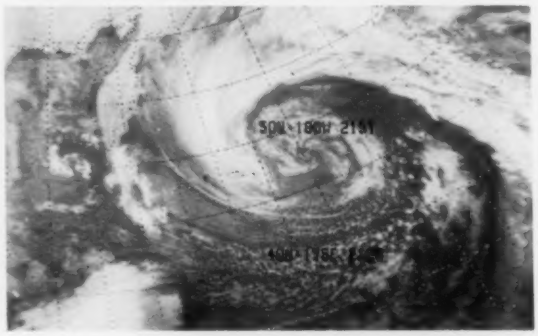


Figure 50.--The storm is centered on the Dateline near 48°N at this time on the 14th. The higher seas and swells were south of the center.

This storm was born in the same general area as the previous one, southeast of Tokyo, on the 15th. It was much weaker in its initial phases bringing only clouds and precipitation as it moved eastward. On the 17th, it reverted to only a frontal wave, but on the 18th, it got a shot in the arm as it moved onto the front side of the major trough, and a minor trough was detectable at 700 mb.

At 1200 on the 18th, the LOW was 972 mb near 45°N, 156°W. The PHEMIUS was about 100 mi east of the center with 45-kn southerly gales and 23-ft waves. Twelve hours later, the central pressure had dropped to 956 mb. A ship at 54°N, 148°W, called in with 60-kn southeasterly winds and 16-ft seas. Many ships were reporting gales. Ocean Weather Station Papa measured 45-kn prevailing winds and 18-ft seas.

The storm had moved to 57°N, 151°W, by 1200 on the 19th. The BREWSTER, near 54.5°N, 152°W, suffered 50-kn winds. The SUMMIT (53°N, 139°W) re-

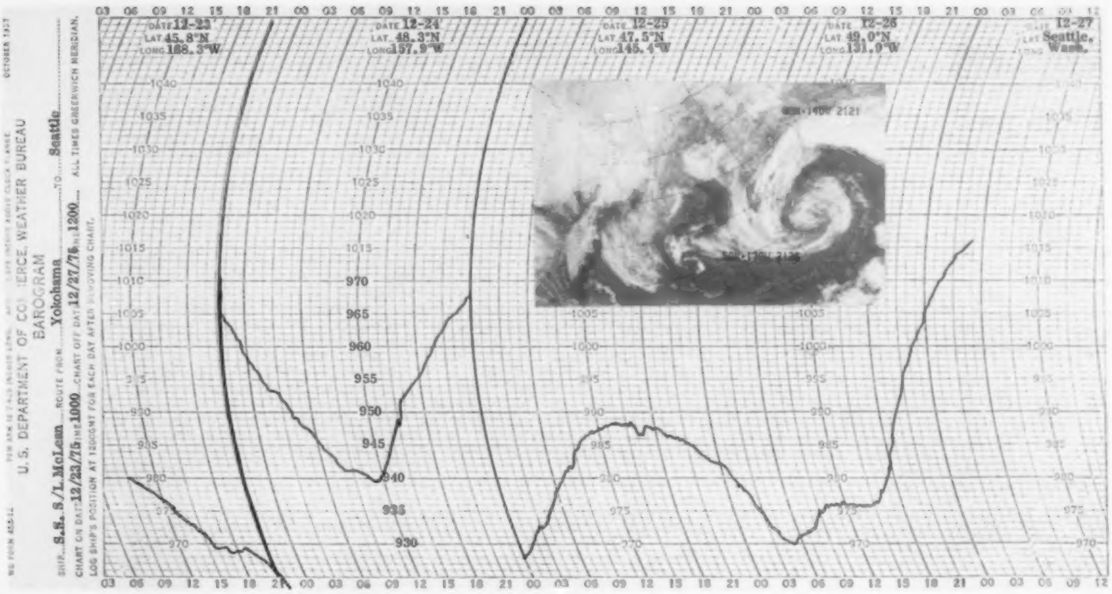


Figure 51.--This copy of the barograph trace from the SEA-LAND MCLEAN partially shows the depth of this extratropical storm even though the ship did not pass through the center of the storm. The inset is an infrared satellite image at 2125 on the 24th.

ported clear skies with 50-kn winds, 13-ft seas, and 34-ft swells. Papa was out of the major wind band with only 35 kn, but the seas were 33-ft. A report by the SULEYMAN STALSKIY appeared to be 65 kn. There were no seas plotted to help verify the wind. On the 20th, the storm moved inland and was lost over the Alaska Range.

The claim to fame of this storm was its low pressure. On the 0000 chart of the 23d, there were seven LOW centers between latitudes 37° and 60°N and the coasts of the continents. One of these, near 37°N, 178°W, had just formed at 992 mb. There was very strong zonal flow aloft as it raced eastward and deepened. By 0000 on the 24th, the pressure had plunged to 948 mb near 44°N, 161°W. At that time, both JAG ASHA and SEVILLAN REEFER reported 50-kn winds south of the center with the latter fighting 20-ft seas and 23-ft swells. North of the center the SEA-LAND MCLEAN was plowing into 45-kn gales and 18-ft waves. By 1200, the LOW was down to 926 mb near 49°N, 156°W. The LOW and the MCLEAN nearly crossed paths about 1000 and reported a pressure of 939 mb (fig. 51).

At 0000 on the 25th, the LOW was analyzed as 928 mb. The INDUS, near 48°N, 151°W, sent in a storm report of 60-kn winds and 41-ft waves. The VANCOUVER ISLAND, near 51.5°N, 164°W, was plotted as having 40-kn winds, 20-ft seas, and 62-ft swells. The swell direction was coded as 99 and period 8.

Late on the 25th and 26th, the storm was filling, and there were isolated gale reports. On the 27th, the storm stalled over the Alaska Peninsula and disappeared by the 28th.

Casualties--The American-registered JOHN LYKES (11,891 tons) arrived Honolulu, on the 10th, with heavy weather damage resulting from four bulldozers coming adrift. The 15,934-ton British freighter LONDON PIONEER suffered an explosion in the engine room during rough seas, 800 mi north-northeast of Oahu. Two crewmen were injured. The 9,595-ton Norwegian KRISTIN BAKKE with a doctor aboard was standing by as heavy seas prevented transfer operations. The 32,269-ton STONEWALL JACKSON sustained heavy weather damage, on the 22d, on a voyage for Middle East and Indian ports. The 10,203-ton bulkcarrier KEN LUNG developed cracks in the shell plating during heavy weather off Nagasaki.

ROUGH LOG, JANUARY 1976--There were fewer cyclones than normal this month, but fewer is not necessarily better, as it may mean those that did occur were larger and more intense. In the western ocean, the tracks were shifted about 5° latitude northward. A track extended across the La Perouse Strait to the southern tip of Kamchatka. The intercontinental track originated north of Tokyo and stretched eastward along 38°N to near 160°E where it turned gradually northeastward to enter the Gulf of Alaska slightly south of the Alaska Peninsula. Another track originated near midocean (35°N, 170°W) and entered the Gulf of Alaska near 50°N, 150°W.

The pressure pattern appeared normal, but the centers were more intense. The Aleutian Low at 990 mb, near 50°N, 170°E, was 9 mb lower than normal. A 993-mb secondary LOW was near 50°N, 172°W, versus a 1005-mb climatic Low in the Gulf of Alaska. The 1027-mb Pacific High was at 35°N, 132°W, as com-

pared to a climatic 1020 mb at 30°N, 132°W. The high-pressure center near Great Salt Lake was 7-mb higher than normal.

There were three negative anomaly centers across the northern ocean--a 12 mb in the Sea of Okhotsk, a 10 mb near 51°N, 172°E, and an 11 mb near 53°N, 160°W. A positive 7-mb center near 40°N, 130°W, extended into the northwestern United States to an 8 mb north of Great Salt Lake.

The primary center of circulation at 700 mb was shifted eastward over southern Kamchatka rather than the Sea of Okhotsk and lower in height. An abnormal closed HIGH was centered near 31°N, 134°W. This increased the sharpness of the ridge that is normally located over the west coast of North America. A large negative anomaly encircled the northern ocean from the Alaska Peninsula to Mys Lopatka. A large positive center was located over the coast of Oregon.

Typhoon Kathy formed over the western ocean late in the month.

Extratropical Cyclones--The first significant storm of the month moved across the Tatar Strait on the 1st. As it moved over the Kuril Trench, it deepened rapidly to 978 mb. The SURUGA MARU, near 39°N, 140°E, found 45-kn gales. By 0000 on the 3d, the 978-mb LOW was near 44°N, 160°E. Two ships encountered 50-kn winds. They were the HAKUSAN MARU (36°N, 158°E) and the ZENKOREN MARU (39°N, 168°E). Other ships were reporting gales at various distances from the center. The highest waves were 20 ft as found by the IBARAKI MARU near 35°N, 154°E.

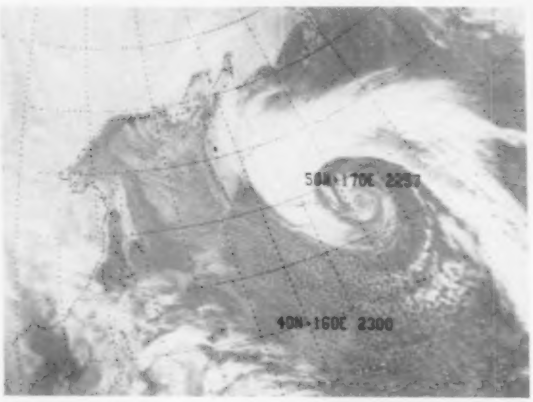


Figure 52.--The edge of the cirrus clouds north and east of the center is very sharply defined and usually denotes a sharp decrease in the upper wind speeds.

At 0000 on the 4th, the LOW was 960 mb (fig. 52) and the CHUETSUSAN MARU, near 46.5°N, 167°E, was 180 mi southwest of the center ploughing into 60-kn winds with mild 13-ft seas and swells. About 600 mi southeast of the center, along the front, the SEA FAN was fighting 60-kn southerly winds. The higher waves were far south of the center, between 30° and 40°N, with the highest--31 ft--reported by the OSAKA BAY near 34°N, 171°E.

On the 5th, the 970-mb LOW was headed due north along 170°E and into the Bering Sea. The LOW started filling rapidly over the cold water, and no longer existed late on the 6th.

A cyclonic circulation intensified over the eastern Sea of Japan late on the 7th. As it moved across Honshu, on the 8th, it split into a double LOW, and the eastern one became the primary LOW on the 9th. At 1200, the MEISHUN MARU, near 48°N, 158°E, was sailing with heavy snow and 45-kn east-northeasterly winds.

At 0000 on the 10th, the 972-mb LOW was near 49°N, 160°E. Fifty-knot winds were reported on three sides of the center by the HOTAKA MARU, MEISHUN MARU, and Ostrov Paramushir. At 1200, the high winds were southwest of the center. Ostrov Ketoy measured 60-kn winds, and the MEISHUN MARU still had 50-kn winds at 47°N, 156°E. At this time, the LOW was nearly stationary with the highest wind of 45 kn. The HOTAKA MARU fought 33-ft swells near 48°N, 160°E.

On the 11th, another LOW was approaching from the east and, on the 12th, became the major circulation which meandered near Mys Lopatka until the 15th.

This LOW was associated with frontalgenesis over the northern Philippine Sea. It tracked more northerly than most storms that form over this area. Late on the 18th, it was moving nearly due north. Three ships reported 40-kn gales on the charts. At 0000 on the 19th, the 975-mb LOW was near 46°N, 161°E (fig. 53). The SEA-LAND FINANCE (41°N, 168°E) and the KENJYU MARU (42.5°N, 154°E) both radioed 50-kn reports. Farther north and east of the center, the ROKKOHSAN MARU, near 47°N, 167°E, fought 55-kn winds and 25-ft seas. Later that day, the storm absorbed another LOW that was over the Sea of Okhotsk and at 1200 was 960 mb, near 53°N, 160°E. Ostrov Beringa measured 70-kn winds. One of the Kuril Islands reported 50-kn winds. The KANEYOSHI MARU (53°N, 165°E) had 25-ft swells on the port side.

The storm moved northwestward into the Sea of Okhotsk, on the 20th, and the WAKANESAN MARU

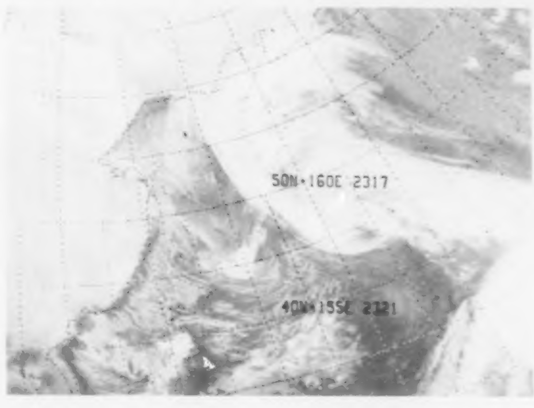


Figure 53.--The center of this storm is not well defined in the high clouds, but it appears to be near 45°N, 163°E, at this time on the 18th.

contended with 33-ft swells near 53°N, 165°E. The LOW circled over the Sea of Okhotsk and dissipated on the 21st.

This incipient circulation was first discovered on the 0600 chart of the 21st in the southwestern quadrant of another LOW. At 1200, the tightened gradient brought 50-kn winds to the ASIA MARU, near 32°N, 149°E. The center of circulation moved northeastward and deepened rapidly. Forty- to 45-kn gales were found along 35°N, but the highest seas of up to 23 ft were along 30°N. At 1200 on the 22d, the LOW was on a northward track and of the same strength as the parent LOW near Mys Lopatka. Winds up to 55 kn were reported around that system by the SHIMA MARU, near 47°N, 158°E, with waves to 26 ft.

At 0000 on the 23d, the TONAMI MARU was north of the center, near 50.5°N, 179°W, with 60-kn easterly winds. At 1200, the 964-mb LOW with two subcenters covered the western ocean south to 25°N and east to 150°W. Even though the circulation was large, the gradient produced only a few gale-force winds. On the 24th, the circulation started breaking down into many subcenters. The subject LOW circled south of the Aleutians until disappearing on the 26th.

This was one of the subcenters of the previous storm. It developed, near 34°N, 173°W, as a wave on a developing front. A report from the CAPE ESAN was the initial cue to its formation on the 0000 chart of the 25th. Twenty-four hours later at 0000 on the 26th, the 960-mb LOW was near 44°N, 155°W (fig. 54). The ZENKOREN MARU No. 5 was very near the center with 45-kn northeasterly winds. To the south, near 35°N, 164°W, the AGANO MARU was suffering 50-kn winds and 20-ft waves. Even farther to the northeast, near 50°N, 128°W, a ship whose call letters were obscured by the analysis fought 65-kn southerly winds. Not far away, the GRACE encountered 45-kn gales.

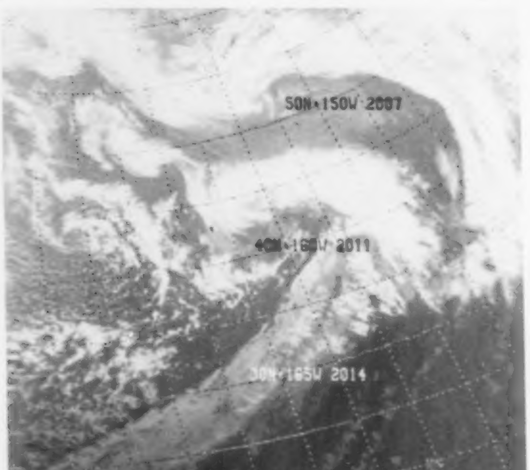


Figure 54.--Another storm with an ill-defined center. The high winds were very well defined to the ships in the area.

On the 27th, many ships were reporting gales. The PACIFIC LOGGER, at 52°N, 144°W, reported 50-kn winds. At 1200, the PORTLAND was pounded by 28-ft swells on the starboard side. At this time, the LOW was moving ashore near Yakutat to become lost in the mountains.

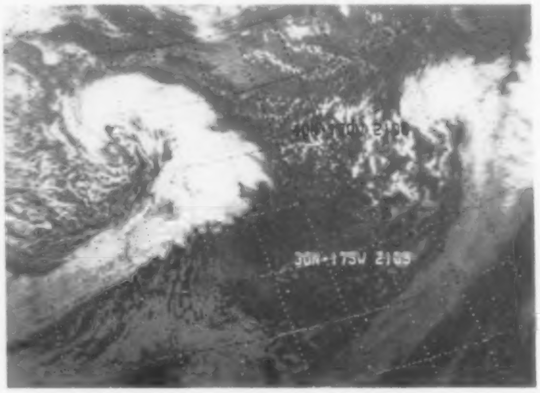


Figure 55.--Sixty-knot winds are blowing beneath those seemingly innocuous cumulus clouds south of the center.

This was a late-forming subcenter of that large cyclonic circulation over the northern ocean. It was first detected at 0600 on the 26th, near 43°N, 162°E. Within 18 hr, it was howling at up to 60 kn by actual reports (fig. 55). The FRESNO CITY, near 41°N, 167°E, caught the 60-kn wind. Two ships near 40°N, 170°E, one the ASIA BRIGHTNESS, found 50- and 55-kn winds and 26-ft seas. Other ships in the southern quadrant found 35- to 45-kn winds and waves up to 20 ft.

The 954-mb center was headed toward the northeast on the 28th. The PRESIDENT VAN BUREN was hit by 40-kn winds. On the 29th, the LOW entered Bristol Bay where it disappeared on the 30th.

Tropical Cyclones, Western Pacific--For the second year in a row and the 10th time since 1945, the western North Pacific spawned a January typhoon. Kathy came to life near 6°N, 148°E, on the 28th. As a tropical storm, she headed west-northwestward, passing northeast of Yap Island on the 30th. She became a typhoon that same day. However, Kathy was already beginning to recurve toward the northeast. She reached her peak the following day as winds rose to 80 kn near her center, shortly after crossing the 15th parallel. On the 1st, the 3JGF encountered 40-kn northwesterlies in 20-ft seas some 200 mi southwest of the center. Late in the day Kathy was downgraded to tropical storm status and was turning extratropical. She completed this transformation on the 2d.

Casualties--On the 3d, it was reported that the 11,720-ton Liberian bulkcarrier ROSE S. with a cargo of scrap and logs was diverted toward Honolulu with flooding in the No. 1 hold in rough seas and high winds.

Marine Weather Diary

NORTH ATLANTIC, APRIL

WEATHER. During April, weather conditions over the middle and northern latitudes are generally much more settled compared to the preceding month. Thus, intervals of favorable weather are more frequent and usually of longer duration. There is a notable reduction in the frequency and intensity of winter-type LOWs. The 1007-mb Icelandic Low lies off Kap Farvel near 59°N, 41°W. The Azores High (1021 mb) is centered more than 1,700 mi farther south near 30°N.

WINDS. The prevailing wind north of 40°N is generally from the westerly quarter of the compass except over the Norwegian Sea, where winds are quite variable. Within this large belt, about 55 percent of the observations report winds of force 4 to 6. From about 40°N southward to the northern boundary of the trades, the prevailing wind is mostly southwesterly, although winds with an easterly component are prevalent off the east coast of Florida out to 70°W, and over the Gulf of Mexico. Near the coasts of Morocco and Portugal, northerly winds dominate, and westerly and northwesterly winds hold sway over the Mediterranean Sea. The winds north of the trades and south of the westerlies are weaker than their counterparts north of 40°N--only about 45 percent of all observations yield winds of force 4 to 6. The trades are more firmly entrenched in April, as compared to March. They usually prevail south of 25°N and, in the eastern North Atlantic, extend to about 30°N. Fifty to 75 percent of the time, they are force 3 to 4.

GALES. The area subject to gales decreases greatly in the middle and northern latitudes, compared to March. The most southern point of the 10-percent frequency boundary has moved northward to 53°N, 45°W. The area affected is enclosed by that point to 60°N, 15°W, to 62°N, 25°W, to 65°N, 28°W, to 63°N, 55°W, to 53°N, 45°W. A small area (about 6° square) of 10-percent frequency is centered east of the Grand Banks near 47°N, 38°W. Gales also spread over the Gulf of Lions about 10 percent of the time.

EXTRATROPICAL CYCLONES. Principal areas of cyclogenesis during the spring months (March, April, and May) are found in a broad area from Cape May down to Georgia on the United States east coast, east-northeastward out to the central ocean, including the waters around Newfoundland. Within this region, cyclogenesis is concentrated from the coasts of Virginia and North Carolina northeastward to a point near 39°N, 66°W. Other principal areas of cyclogenesis lie around the south coast of Iceland; over most of the Baltic Sea, including Danish waters, but not including the Gulf of Bothnia; off Norway's arctic coast; over the Bay of Biscay; and over the Gulf of Genoa, the northern and central Adriatic Sea, and the southwestern Black Sea. Primary storm tracks in April are much the same as in March. One track begins about 250 mi east of Cape May and travels northeastward over the Grand Banks. The storms heading northeastward across the North Atlantic tend to pass a little farther south of Iceland than in March. Over the Mediterranean, the primary storm track reaches northern Italy, but does not extend to southern Turkey as it did in March.

TROPICAL CYCLONES have not been reported during April in the North Atlantic in the past 104 yr. This is the only month of the year in which no tropical storm activity has occurred.

SEA HEIGHTS of at least 12 ft are found more than 10 percent of the time north of a line extending from Labrador around the eastern margin of the Grand Banks to 41°N, 50°W, westward to 70°W. The same line curves eastward along the 36th parallel to 60°W, and then across the North Atlantic to Ireland and central Norway. Another small area of 10-percent frequency extends from the Gulf of Lions southeastward to a distance of 150 mi out over the Mediterranean. An elliptically shaped area of 20-percent frequency extends from latitude 55° to 60°N, and across longitudes 15° to 55°W.

VISIBILITY. Occurrences of low visibility increase over the western part of the North Atlantic, especially west of 40°W. The greatest change from March takes place over the Grand Banks and the waters south and east of Newfoundland, where over 20 percent of the observations show visibilities of less than 2 mi. Visibility over the Norwegian Sea has decreased in the west and increased in the east. The area of 10-percent frequency of low visibility over the North Sea has moved southwestward and extends from the tip of southern Norway to the coast of Great Britain.

NORTH PACIFIC, APRIL

WEATHER. The weather over the North Pacific generally shows marked improvement over that of any month since October. Compared to the winter months, periods of storminess are fewer, but severe extratropical LOWs are still encountered occasionally. The Aleutian Low has filled to three 1009-mb centers along 55°N. Its configuration is that of a banana, bridging from the Gulf of Alaska to the Sea of Okhotsk. The 1012-mb isobar orientation has changed very little over the past months, except the southern boundary has moved steadily northward with spring, now approximating 50°N. The three LOWs are located just east of Kamchatka, in the middle of the Bering Sea, and in Bristol Bay. The Pacific High is expanding with two major centers near 32°N, 159°W, and 32°N, 178°W.

WINDS. Over about half of the North Pacific between 40° and 55°N, the windspeeds are of force 4 to 6 in 50 to 65 percent of the observations. The remainder of this latitudinal belt, especially near the coast of North America, experiences winds of force 3 to 5. The prevailing winds are from the westerly quarter. Between 30° and 40°N, winds are variable west of 170°E, mainly southwesterly between 170°E and 150°W, and westerly to northerly east of 150°W. Forces 3 to 5

are recorded in 45 to 70 percent of the observations. Variable force 5 winds often blow over the western half of the Bering Sea, and northerly force 5 winds are quite common over the eastern half. Easterly winds of about force 4 sweep over the northern Gulf of Alaska. South of Japan, easterly force 4 winds prevail, and winds from any direction except west and southwest are common over the East China Sea, where force 3 to 4 is the rule. The "northeast trades" prevail south of 25°N, over the western ocean between the dateline and the Philippines, and south to 30°N over eastern waters. The trades blow at about force 4, except near the Equator and over the Philippine Sea, where force 3 winds prevail. The northeast monsoon continues to dominate the South China Sea, but with less strength and steadiness than in the colder months. Winds of force 2 to 3 account for between 46 and 63 percent of all observations. Northerly winds continue to prevail south of the Gulf of Tehuantepec, but gales over the Gulf now occur less than 5 percent of the time. Force 2 to 3 winds are experienced 50 percent of the time, compared to 40 percent in March.

GALES. Two areas of high gale frequencies, 10 to almost 20 percent, persist as a residual of the winter month in the middle and northern latitudes. One holds sway over the Gulf of Alaska south of Kodiak Island to about 52°N, and eastward to near 140°W. The other is a belt 250 to 370 mi wide that lies east of Honshu from about 36°N, 147°E, northeastward to about 45° to 48°N, and 178°E.

EXTRATROPICAL CYCLONES. The principal area of cyclogenesis stretches from south of Kyushu northeastward to about 700 mi south of Beringa Island. A primary track from across Sakhalin Island combines with the one above and follows the Aleutian Islands into the Gulf of Alaska. About 180°, a branch shoots off to the northeast toward, and over, the Pribilof Islands. About midway between Hawaii and Adak, a track points northeastward toward Yakutat. A secondary cyclone path enters British Columbia near the southern tip of the Queen Charlotte Islands. The storm tracks have moved slightly northward over the western waters. The intensity of the storms has started to decrease, resulting in fewer gales.

TROPICAL CYCLONES. In an average 10-yr period, about seven tropical storms can be expected over Far Eastern waters. About 80 percent of these, or 4 out of 5, have developed to typhoon strength. Tropical cyclones develop in the same region as they did in March, east of the central and southern Philippines and west of 170°W, but the area affected by these warm-core storms has expanded northwestward to include the waters east of Luzon and around Taiwan. A tropical cyclone in the eastern North Pacific in April would be a rarity.

SEA HEIGHTS. The area where there is at least a 10-percent frequency of 12-ft, or higher, seas is roughly bounded by 155°E and 150°W on the west and east, 52°N on the north, 32°N on the southwest corner, and 45°N on the southeast. An area of 10-percent frequency of swells equal to, or greater than, 12 ft parallels the coastline of North America, including the Aleutian Islands, and joins the western half of the above area.

VISIBILITY. Reduced visibility (less than 2 mi) of 10-percent, or greater, frequency extends to the north of a line drawn from Sakhalin southeastward to about 40°N, 160°E, and then east-northeastward to about 45°N, 175°W. From there the line swings northward to Amlia Island in the eastern Aleutians, and then eastward to about 50°N, 150°W, before cutting back across the Alaska Peninsula to the Bering Sea, east of St. Lawrence Island. The area of 20-percent frequency has decreased in size since March and is now centered over the northern Kurils.

NORTH ATLANTIC, MAY

WEATHER over the North Atlantic continues to moderate during May. The Azores High builds slightly to a central pressure of 1022 mb near 31°N, 40°W, while the Icelandic Low centered several hundred miles southeast of Greenland's southern tip fills to about 1012 mb.

WINDS over the greater part of the ocean between 40° and 55°N are generally westerly, except northeasterly over the Baltic Sea, but with less persistence than earlier in the spring. The average windspeed north of 40°N is force 4. Winds are quite variable between 55° and 60°N and are generally northerly north of 60°N. Between 25° and 40°N, winds are somewhat lighter, generally of force 3. West of 40°W, within the above latitudinal belt, south and southwest winds tend to prevail; while east of this longitude, winds from the northerly quarter of the compass are by far the most frequent of all. Over Mediterranean waters, west-northwesterly winds of force 2 to 3 are the most common. The Gulf of Mexico plays host to easterly force 3 winds. The "northeast trades," force 3 to 4, dominate the wind regime between 5° and 25°N, except along the African coast, where they extend northward to about 30°N. South of 5°N to the Equator, the force 2 to 3 winds almost always have an easterly component.

EXTRATROPICAL CYCLONES continue to develop frequently from off the Carolina coast northeastward to Newfoundland, but are becoming less severe. The direction of movement from Newfoundland is generally either north toward the Davis Strait, or northeast toward the Norwegian Sea. Two primary tracks affect the Great Lakes. One runs east-southeastward from Lake Winnipeg to south of James Bay. Another follows a line from eastern Iowa across southern Lake Michigan and southern Lake Huron to lower Quebec. After meeting, the two tracks proceed as one to the Gulf of St. Lawrence.

GALES are rare below 40°N, and their frequency and duration in higher latitudes are less than in the preceding months. The area of maximum likelihood of gales, 10 to 20 percent, generally is located from the southern tip of Greenland southward to about 52°N, between 40° and 56°W.

TROPICAL CYCLONES are infrequent during May. During the 44-yr period 1931-74, nine tropical storms have occurred, and two of them attained hurricane force.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Environmental Data Service
Washington, D. C. 20235

Postage and Fees Paid
U. S. Department of Commerce
Com-210
Special Fourth-Class Rate Books

SEA HEIGHTS of 12 ft or more are encountered from 5 to 10 percent of the time along the northern shipping lanes, from several hundred miles east of the Chesapeake Bay to the northern Norwegian coast, excluding the North Sea and the Bay of Biscay, but including the Gulf of Lions southeastward to Sardinia. The frequency increased to more than 10 percent in the midocean area and to more than 20 percent south of Kap Farvel.

VISIBILITY limited to less than 2 mi is encountered 10 to 20 percent of the time over the western North Atlantic, from about 40°N, 65°W, northeastward to a point near 53°N, 30°W, and then westward to the Labrador Sea. The line, north of which frequencies are greater than 10 percent, but less than 20 percent, then extends northeastward over Kap Farvel to north of Iceland, and through the Norwegian Sea to the Barents Sea. Visibility less than 2 mi also occurs between 10 and 20 percent of the time over a great part of the northeastern North Sea. Frequencies increase to over 20 percent of the time over the Grand Banks and off the southwest coast of Greenland.

NORTH PACIFIC, MAY

WEATHER continues to improve slowly over the North Pacific in May. The subtropical High has an average central pressure of about 1022 mb and is located near 34°N, 152°W. The Aleutian Low becomes a broad weakening trough extending from the Asian mainland eastward to the western Gulf of Alaska. The lowest pressure, about 1008 mb, is centered over the west-central Bering Sea.

WINDS north of the 25th parallel tend to come from the westerly quarter of the compass, but variable winds are present over a number of locations on either side of the dateline. Winds over the Gulf of Alaska are easterly at force 3 to 4. Along the coast of the United States, northwesterly components are pronounced. Between the Equator and 25°N, (30°N, east of 180°), the "northeast trades" are very steady, except over the southern half of the South China Sea, where southerly winds of the southwest monsoon have established themselves. These monsoon winds are usually force 2 to 3, though lighter winds are not unusual. Over most of the rest of the North Pacific, windspeeds average force 3 or 4. Northerly and westerly winds prevail out from the Gulf of Tehuantepec, with easterly and northwesterly winds close behind. Speeds are force 2 or 3, 48 percent of the time.

EXTRATROPICAL CYCLONES continue to develop over the Ryukyus and then move east-northeastward toward the Gulf of Alaska. A second primary storm track crosses the Siberian coast and Sakhalin, continues eastward across the northern Kuril Islands, and then curves toward the southern Bering Sea.

GALES decrease in frequency. In midocean between 40°N and the Aleutians, the chance of encountering gale-force winds remains slightly above 5 percent. Two smaller areas of similar frequency are found near the Alaska Peninsula and over the southern part of the Gulf of Alaska.

TROPICAL CYCLONES. Tropical storms occur, on the average, slightly more than once each year over the western ocean. There have been some years with none, but some with as many as four. Roughly 75 percent of these tropical storms become typhoons. The areas of most frequent development are south of 20°N, from the Carolines westward across the Philippines and the South China Sea. About once every 2 yr, a tropical storm or hurricane develops over the ocean area off Mexico during May.

SEA HEIGHTS. Seas of 12 ft or more continue to decrease in frequency as the winds decrease. The area of 10 percent or greater has the shape of a long balloon squeezed in the middle. The northern boundary parallels the Aleutian Islands about 400 mi to the south, between 160°E and 148°W. The southern boundary is 40°N over the western, and 45°N over the eastern ocean. High swells continue to be observed off the Asian and northern coasts, with a larger area in midocean very roughly bounded by 30° and 50°N, 155°E and 170°W.

VISIBILITY less than 2 mi occurs more than 10 percent of the time over the western North Pacific Ocean north of 35°N, and over the eastern North Pacific Ocean north of 42°N and west of 140°W, excluding the Gulf of Alaska and the waters southeast of the central Aleutians. Over the northern Kurils, this low visibility occurs more than 30 percent of the time.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1976—210-926:4